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Dynamics of agricultural land-use change and rural livelihoods in Southern Bhutan

Local perspectives from Tashithang village

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List of Abbreviation

FEC  Final Energy Consumption
FYP  Five-year-plan
GNH  Gross National Happiness
MoAF Ministry of Agriculture and Forestry
NEC National Environment Commission
NOP National Organic Program
PPC Plant Protection Chemicals
RGoB Royal Government of Bhutan
RNR Renewable Natural Resources
TOE Tonne of oil equivalent

Glossary of Bhutanese Terms

*Buedulum Chhu*  Name of the watershed that builds the larger context for this study
*Chhu*  River
*Chiwog*  Village or a group of villages
*Chhuzhing*  Irrigated bench-terraced cropping systems (mostly paddy)
*Dzongkhag*  District
*Geog*  Block/administrative unit/County
*Gup*  Elected leader of a geog
*Kamzhing*  Dryland. Land category other than Chhuzhing and orchard
*Kidu*  Granting of land by His Majesty the King to citizens of Bhutan
*Tshogpa*  Chiwog representative
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Abstract

Bhutan, a small country in the eastern Himalayas follows a, internationally noticed, holistic development approach with ambitious attempts for sustainability based on a national environment strategy and a far-reaching vision to produce 100% organic production by 2020. Based on a local case study in Tashithang village, sited in the Buedulum Chhu critical watershed in Southern Bhutan, this thesis builds on empirical data from an agent-based approach that includes farmers’ decisions and external driving forces on land-use change. Qualitative, ethnographic methods, including participant observation and semi-structured interviews with farmers and experts, were used to raise perspectives on the local land-use transition, supposed to happen. Multiple, human and natural causes of agricultural land-use change were found and influence human-environment relations on a local scale and are interrelated with other sectors of society. A wider process of livelihoods diversification and market integration, driven by profitable cash crops, was noticed as a main driver for land use change that puts pressure on the cultivation of food crops for household consumption. The introduction of a stable-feeding system for dairy production concurrently leads to intensification of the livestock system. Prevalent shortage of labour was identified as a severe issue in the village that derives from changing demographical patterns caused by family planning programs and migration movements, mainly driven by incentives from education for rural-urban migration of the educated youth that are tackled by different land use strategies mainly on an organizational level in addition with fossil fuel-driven agricultural technologies.

Keywords: Bhutan; Agriculture; land-use change; socio-ecological transition; participant observation;
1 Introduction

From a 'universal' history perspective, the current global human-environment relation is seen as unsustainable at its core due to the use and conversion of large amounts of accumulated, non-renewable energy carrier and subsequent negative environmental consequences (Sieferle, 2001). Spreading from the industrial core countries, major parts of regions worldwide are currently in a rapid socio-ecological transition (Krausmann et al., 2008) with far-reaching consequences for human and natural systems. Pointing on the pervasiveness and magnitude of human-induced impacts on the earth system, scholars even discuss to name our current geological epoch anthropocene (Steffen et al., 2011), and propose a new framing of global sustainability that builds on 9 planetary boundaries, including (I) climate change, (II) ocean acidification, (III) stratospheric ozone, (IV) global phosphor and nitrogen cycle, (V) atmospheric aerosol loading, (VI) freshwater use, (VII) land use change, (VIII) biodiversity loss and (IX) chemical pollution (Rockström et al., 2009). These boundaries shall not be transgressed in order to avoid collapse of natural and societal systems deriving from non-linear, acute environmental changes on continental- to planetary-scale systems. Land-use and land-cover changes, aggregated on a global scale, count for one of the major aspects that alter Earth system functioning (Lambin et al., 2001).

In this study I want to examine causes of land-use change on a local scale that are inherently linked to underlying driving-forces of a larger socio-ecological transition from a so-called agrarian to an industrial socio-metabolic regime. In agrarian societies, agriculture provides energy in form of food, feed, fiber and fuel wood and thus determines its level of complexity based on the use of solar energy as main energy source and the subsequent conversion of biomass into available energy. Instead, agricultural land-use is nowadays, in times of industrial transformation, losing its role as sole energy provider of societies and gets subsidized by implicit and explicit fossil-driven technologies that gain increasingly influences in transitory regions and raises questions of sustainability (Marina Fischer-Kowalski et al., 2014b).

The understanding of causes for agricultural land use-change has a long and prominent history among scholars with a focus on demographical change, dating at least back to 1789 and Malthus' "Essay on the principle of Population" (Malthus and Flew, 1985) in which he identified a possible "population trap" resulting from geometrical growth in food production against exponential population growth. (Boserup, 1993) argued against Malthusian/Neo-Malthusian theories and laid the cornerstone for a more 'anthropocentric' theory on agrarian change that has been discussed and developed further among scholars coming from different fields (Ali, 2007; Marina Fischer-Kowalski et al., 2014b). Concurrently, scholars have raised critique on single-factor explanations for land-use change that are seen as too simplistic (Brookfield, 2001); (Lambin et al., 2001). Authors have rather moved from simplistic representations to a much more profound understanding that involves situation-specific interactions among a large number of factors at different spatial and temporal scales (Lambin et al., 2003).

The here presented study raises perspectives on the complex and interrelated field of land-use change with implications for livelihoods on a local community level. Based on a local case study I want to describe critical interconnections in the field of socio-ecological transitions that raise questions of future sustainability pathways.

Empirical fieldwork for this Thesis was conducted in an agricultural dominated, local community in the small Himalayan state of Bhutan. The subsistence-oriented, biomass-driven Bhutanese economy, present before the advent of modernization in the 1960s, is increasingly shifting towards a modern market economy with hydropower-electricity export and tourism as major revenue sources (Rinzin, 2006). The importance of agricultural land-use in Bhutan has at the same time declined strongly over the past decades. In 1980/81 agriculture provided livelihoods to about 90 % of the population with a contribution of 47 % to GDP (GNHC, 1981). This share declined to 62.2 % of people that are directly dependent on agriculture for their livelihoods in 2012 (GNHC, 2013) and an economical contribution of 12 % to GDP in 2010/2011 (Khan and Robson, 2015). Bhutan represents a particular case in regard to development and policy strategies including environmental policies. The country builds on the holistic development philosophy of Gross National Happiness comprising four
main pillars: I Sustainable and equitable economic development; II Conservation of the environment; III Preservation and promotion of culture; and IV Good governance. The "middle-path-strategy", a national environment strategy is used as main implementation tool with the aim to achieve a sustainable development in Bhutan (NEC, 1998). Moreover, the government has raised international attention for their vision to become the first country worldwide with 100 % of its agriculture becoming organic (Confino, 2014).

My study is based on an integrated research approach that derives from qualitative research and can be termed as 'focused' or 'short-term' ethnography. Based on a literature review and data from preceding studies in the project region, I put a focus on causes that contribute to a shift from subsistence oriented agriculture to a more cash crop oriented farming system in the region. A variety of qualitative place-based research methods, such as semi-structured and ethnographic interviews, with participant observation at the core of the approach, were taken to raise perspectives on this issue. My theoretical approach to this topic is an agent-based approach as it "is centered on the general nature and rules of land-use decision making by individuals. It represents the motivations behind decisions and the external factors that influence decisions about land use" (Lambin et al., 2003: 229). Drawing on a theoretical underpinning of socio-metabolic transition theory and causes of land-use change, I argue that general patterns concerning land-use change might help to understand processes on a local level, whereas the unique causes need individual examination.

1.1 Fieldwork in Bhutan

The Bhutanese vision to produce 100 % organic food, in combination with an aim that "sustainable development should take a holistic approach towards notions of progress and give equal importance to non-economic aspects of wellbeing" ("Gross National Happiness » GNH INDEX," n.d.) attracted my attention. The field of agriculture in combination with questions of modernisation, ecological implications and people’s well being were core interests during my studies in agricultural sciences (BSc) and Social ecology in Vienna. I conducted my Bachelor Thesis in a small rural community in western Ecuador on local ecological knowledge and the dissemination and continuation of this knowledge to the young generation. As I gained more insights into this complex field of agriculture and land-use, the wish to actively intervene and support people’s sustainable livelihoods got complemented and replaced by a more descriptive and careful way of approaching this field of agricultural transitions and their implications on livelihoods. The focus of my fieldwork in Bhutan was thereby laid on the notion to throw light on the field of interests from as many perspectives as possible in order to show its complexity and give new and fruitful insights for the project and research community. An actual research project between the University of Natural Resources and Applied Life Sciences in Vienna (BOKU) and the Bhutanese research centre RNR-RDC Yusipang with the overall goal of “enhancing livelihoods in Bhutan through improved adaptation measures to climate change and increased carbon stocks” is in progress since 2013 comprising 6 work-packages in a watershed in Dagana District and gave me the opportunity to bring in my research interests. As part of the work-package no. 3 this Master Thesis tries to draw a broader picture of the conditions that lay behind the process of agricultural land-use change, its risks, challenges and implications for rural livelihoods in the region.

1.2 My research interest

Given the forward-looking development paradigm of Gross National Happiness in Bhutan in combination with a vision for an agriculture that builds 100% on organic produce, my research interest is largely about gaining a better understanding on how, if at all, these policies translate into practice at the local community level. Are they having an influence on farmers’ decision-making on how they use their agricultural land? What are other influencing factors for local farmers to change their livelihood strategies/land use change?
1.3 Research questions

What are current dynamics of agricultural land-use in a village in southern Bhutan with a focus on farmers’ sustainable livelihoods?

- Which decisions are taken by farmers in Tashithang village in order to sustain their living?
- What are main drivers of change in the village of Tashithang?

1.4 Research purpose and objectives

A main purpose of this Master Thesis is to get a more detailed understanding on the complex and interrelated process of land-use change in an agricultural dominated region. Thereby I want to contribute to an existing research project in southern Bhutan concerned with the improvement of rural livelihoods. At the same time I want to contribute to the scientific discourse about land-use change and land-use transitions. Building on an ethnographical approach, the findings shall give complementary perspectives upon the questions of agricultural land-use change as being part of a broader socio-metabolic transition and describe possible implications for people’s livelihoods in the region. In a finite way, this thesis with a focus on agricultural land-use change shall reveal points of interest under changing circumstances: Asking about bygone living conditions, focussing on current livelihoods strategies and giving a glimpse upon future prospects of farmers about their livelihoods in the village of Tashithang.

The objectives of the Master Thesis are:

- Describing livelihoods and decisions, taken by farmers in Tashithang, in order to sustain their living.
- Describing important drivers of change and how they are interconnected with farmers’ decisions.
2 Related concepts and theories

Chapter two of this thesis is divided into two sub-chapters that illuminate different dimensions of agricultural land-use change. First, (2.1) a meta-structure is delivered by the theory of socio-metabolic transitions. The meaning of this concept is twofold. First, it serves as a historical meta-structure that provides arguments to discuss sustainability issues in Bhutan from a broader socio-ecological perspective. Secondly it shows a part of the theoretical preconditions of my studies in social ecology and might serve for a better understanding of the lines of argumentation. In chapter 2.2 I will address classical, as well as more recent literature linked to the field of land-use change. I will start to review classic publications on agrarian change and development, before entering a more recent debate on land-use change in which lines of argumentation rather turned from simplistic to more complex explanations of land-use change.

2.1 Socio-ecological transitions

"Two thirds of the world population are currently within a rapid transition from the agrarian to the industrial regime. Many current global sustainability problems are a direct consequence of this transition" (Haberl et al., 2011:1). A transition with far-reaching implications is also happening currently in the small Himalayan country of Bhutan where the economic base is shifting from a subsistence based agrarian society towards a society with a growing service and industrial sector that relies ever more on hydro-electricity exports as well as on tourism revenues (Rinzin, 2006). Having been largely isolated for a long time, the country is increasingly opening up to the outside world, finding itself in a critical phase of transition. Thus, agricultural land-use change cannot be understood in an isolated way without taking this large and far-reaching transition into account. To approach this issue, I draw on a theory of socio-ecological transitions, namely the theory of socio-metabolic transitions brought forward by the Viennese school of social ecology. This perspective, which was empirically investigated in different regions and on different scales, including global (Haberl et al., 2011); national (Krausmann et al., 2003); and local (Ringhofer, 2010) scale, shall contribute important insights about current questions of sustainability (transition) not only, but also in Bhutan.

The foundation for the concept of socio-metabolic transitions was laid by Sieferle (2003) and then adapted and further elaborated (Fischer-Kowalski and Haberl, 2007), (Fischer-Kowalski and Rotmans, 2009), (Haberl et al., 2011), (Krausmann et al., 2008). The concept is intertwined with other concepts from social ecology, namely the social metabolism with the methodology of Material and Energy Flow Accounting (MEFA) as well as the concept of colonization related to the HANPP1-methodology (see for example Haberl et al., 2007). It is not the aim of this work to step into these concepts but rather to outline particularly interesting aspects of the socio-metabolic transition approach for this study with a minimal effort to explicate the before mentioned theories. The approach of socio-metabolic transitions is focussing on an understanding and the analysis of "[...] contemporary and historical phenomena of radical change in societies linked to the environment" (Fischer-Kowalski and Rotmans, 2009:1). It suggests that there are certain characteristics or patterns that can be generalised among societies and are based on the main source of energy and the main technology of energy conversion, in each case with particular consequences for the society-nature interactions (Krausmann et al., 2008).

"The theory claims that, in world history, certain modes of human production and subsistence can be broadly distinguished that share, at whatever point in time and irrespective of biogographical conditions, certain fundamental systemic characteristics derived from the way they utilize and thereby modify nature" (Krausmann et al., 2008).

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1 Human appropriation on net primary production
2.1.1 Socio-metabolic regimes

To understand socio-metabolic transitions, an important starting point of the theory are socio-metabolic regimes, which can be seen as relatively stable states from where transitions have their starting or ending point:

Referring to the environmental historian (Sieferle, 2003), the theory of socio-metabolic regimes gives a universal history perspective on sustainability and is based on a distinction of three 'socio-metabolic regimes'. Socio-metabolic regimes are framed as forms of organization between societies and their natural environments in terms of exchange of material and energy. Furthermore these regimes can be characterized by a certain "socio-metabolic profile" of the society, which correlates to specific impacts on the environment (Krausmann et al., 2008). "The associated modifications in natural systems [...] occur either as an unintended consequence (such as resource exhaustion or pollution) or as intentional change by society (such as land cover change)" (Fischer-Kowalski, 2011:154).

Sieferle (2003) distinguished the following regimes:
(I): The regime of hunters & gatherers, which is based on an uncontrolled use of solar energy. (II): The agrarian regime, based on a controlled use of solar energy and (III): The industrial regime, defined as the current regime, based on the technical usage of fossil energy. From Sieferles point of view, the latter regime does not have a stable structure but rather is in a process of accelerated transformation² (Sieferle, 2003). This level of aggregation and abstraction of different human societies worldwide under these categories undoubtedly has its problems as the authors admit but, as it is also used here, can open up an analytical frame under which concrete societies or communities might be reviewed in more detail (Sieferle, 2003). In a more technical way, the regimes can be summarized as: "[...] a specific set of rules that regulate the operation of social systems and its institutions, the corresponding bio-physical properties of the social system and the related patterns of society-nature interactions" (Schandl et al., 2008:2). Primarily, these regimes can be differentiated among each other through their main source of energy and the main technology of energy conversion (Sieferle, 2003).

"Accordingly, socioecological systems that have in common the main source of energy and the main technologies of energy conversion will also share many other basic characteristics, such as patterns and levels of resource use (metabolic profile), demographic and settlement patterns, patterns of use of human time and labour [...], institutional characteristics, and communication patterns" (Krausmann et al., 2008:639).

The way societies interact with their natural environment, or in other words, the predominant socio-metabolic regime in which societies exchange energy and material with its environment, may on the one hand facilitate the continuation of the socioeconomic system of a society but, and this is crucial, it can also be a threat for its own perpetuation, as it was documented for different civilizations in human history (Tainter, 2006). This is when we talk about sustainability problems (Krausmann et al., 2008).

2.1.2 What transition are we talking about?

Different strands of thought are found in the literature that deals with transitions of society. As (Hinrichs, 2014) points out, the concept is nowadays used in various disciplines of human and social sciences as in demographical studies or in political science. Transition as such is just implying a shift from one state to the other that is rather gradual and omnipresent than revolutionary in its character. Nevertheless, the consequences of a transition can be far-reaching and even revolutionary (ibid). Transitions between socio-metabolic regimes, as understood by this approach, have often been called 'revolutions' in human history, namely the Neolithic revolution (the

² Sieferle argues in this direction, that the industrial mode is not a stable regime but more a transitional process towards a new regime as it is clear that, in contrast to the agrarian and hunters & gatherers regime, it cannot be sustainable over the long run (Sieferle, 2003) .
transition from hunter-gatherer to the agrarian society) and the industrial revolution (the transition from agrarian to industrial society).

"The emergence of agriculture and animal husbandry roughly 12000 years ago altered human societies and their relationship with the natural environment so fundamentally that this transition process is called with great justification the 'Neolithic revolution'. The term revolution' is also appropriate given the extent of changes that took place as a consequence of this transition process" (Haberl et al., 2011:2).

Proceeding on this path of transition thinking from the past towards the presence, it is said that: "The majority of the worlds regions and economies are still in early phases of an ongoing industrial transformation" (Krausmann et al., 2008:638) and face particular sustainability problems. One very important aspect, also for the case of Bhutan, is that different energy regimes may be found at the same system level.

"Depending on the reasons for and the speed of an energy transition, parts of the system may at a certain point in time be under different energy regimes: urban industrialized centers, for instance, may coexist with traditional agricultural communities, or industrialized countries with agrarian colonies" (Fischer-Kowalski, 2011:154).

In the next sub-chapters I will shed light on important characteristics of the agrarian and the industrial regime and the transition process in-between. It is supposed that parts of these patterns marking an industrial transition can be also found in Bhutan nowadays.

**2.1.3 The agrarian socio-metabolic regime**

"Agrarian ecosystems created by human activity, such as arable land, grazing land and meadows, replaced natural ecosystems, which had provided the habitat for hunters and gatherers; natural landscapes were transformed into cultivated landscapes (‘cultural landscapes’). The central innovation, expressed in the terminology of social ecology, was the appearance of a new kind of society–nature interaction, the ‘colonization of nature’" (Haberl et al., 2011:2).

Societies in this mode live a sedentary life in contrast to hunter and gatherers. A much higher fertility could be managed by agrarian societies, using milk of domestic livestock and ceramic bowls to cook (M. Fischer-Kowalski et al., 2014). The burden of labour that needs to be invested in agrarian societies gives the motivation for a large number of family members that help to share and relieve this burden. The logical consequence, yet it needed time, of an ever-growing population that leads to higher population densities was the expansion of the agrarian regime across the world (M. Fischer-Kowalski et al., 2014). As already mentioned above, the main source of energy and the main technology of energy conversion are used as main indicators to distinguish socio-metabolic regimes. In the socio-metabolic transition from hunters & gatherers to the agrarian regime, the main source of energy remained the same. This is, the use of solar energy through the process of photosynthesis. The difference between these two regimes is, that hunters & gatherers use this energy in a "passive" way as they exploit biomass in form of plants and animals wherever they find it. Farmers have begun in the agrarian regime to use this solar energy actively, channeling the energy source as for their needs. The terrestrial ecosystem is changed in a way that fits them and a selection and protection of certain plants and animals is practiced in order to secure the amount of food and feed (see colonization below). In the agrarian regime, "the production of available energy is based upon the controlled transformation of ecosystems by labour with the aim of increasing the utilisable yield of biomass;" (Fischer-Kowalski et al., 2014:29). The concept of colonization, seen as a specific interaction of social and natural systems that is associated to the agrarian regime can be summarized as followed:
"In order to maintain their metabolism, societies transform natural systems in a way that tends to maximize their usefulness for social purposes. Natural ecosystems are replaced by agricultural ecosystems (meadows, fields) designed to produce as much usable biomass as possible, or are converted into built-up space. Animals are domesticated, genetic codes of species are altered to increase their resistance against pests or pesticides, or to produce pharmaceuticals" (Fischer-Kowalski and Haberl, 1998:3).

However, this process of intensification was and is made at cost of the need for more human and or animal labour, which increases ever more due to the process of agricultural intensification (Fischer-Kowalski et al., 2011).

**A common denominator**
What are the main characteristics of an agrarian regime following the approach of socio-metabolic transitions? Fischer-Kowalski et al. (2010:11) have assembled certain characteristics of an 'ideal typical' rural agrarian community also understood in relation to other regimes. These characteristics are:

- A largely sedentary way of life, and the community being engaged in working the land for its staple food.
- Not to use fossil fuels as a major source of energy.
- To have many children, at least medium population growth rates, and higher population density.
- To maintain substantial biophysical structures (buildings, livestock) and have higher metabolic rates in terms of energy and materials per capita than hunters & gatherers.
- To have working times that increase with agricultural intensification, and a substantial share of child labour.
- To have less time to spend on cultural community activities.

From a meta-perspective, it can be said that: Socio-ecological systems of an agrarian regime are not static, but can be seen in a dynamic equilibrium, which depends on certain system parameters. A population of these systems is claimed to invest labour to cultivate land and to produce different types of biomass such as food, feed, fiber and fuel in sufficient amount to maintain a stable population (Krausmann et al., 2008). Resulting from that, "[...] biomass was by far the most important energy source until the industrial revolution, generally accounting for 99 % of all available primary energy" (Marina Fischer-Kowalski et al., 2014: 29).

(Schandl et al., 2008) point out, that the amount of available primary energy in agrarian regimes depends on a combination of area productivity and the efficiency of biomass conversion. However, the energetic base of biomass is the primary energy source available and consists mainly of nutrition and animal feed to sustain the life of humans and their livestock and can be further converted into mechanical energy as physical work (Marina Fischer-Kowalski et al., 2014).

"[...] Food output has to be significantly larger than the food equivalent of the invested labour; otherwise a stable population can not be maintained. The minimum energy return on investment is given by demographic requirements but an agricultural population may even produce a significant surplus that allows it to sustain a nonagricultural population and production" (Krausmann et al., 2008:640)

Following this thought, the seemingly simple equation for the agrarian regime is and was: "the higher the surplus, the more complex the possible societal structures become" (Marina Fischer-Kowalski et al., 2014b: 29). But there is still a clear limitation for the level of complexity possible to reach for societies based on biomass. It is argued that the surplus is never particularly high, as such a system needs to be well organized to sustain 1–2
nonagricultural households\textsuperscript{5} from 10 farming households generating surplus. If such a society, which is based on the positive energy return on investment through agriculture, needs to feed an increased number of people, it is necessary to either extend the territory for land-use or to increase the biomass output per unit of area. This intensification process\textsuperscript{4} is argued, requires more human or animal labour and is limited by diminishing marginal returns (Krausmann et al., 2008). Apart from this limitation to produce enough food and raw material for both the agricultural and the non-agricultural population, another limitation factor (therefore also for urbanization) is the transportation of goods. Only waterways allow a suitable transport over long distances, which "[…] implies limitations for the exchange and for the spatial concentration of staple food, feed, and fuel, which are produced at low energy densities" (Krausmann et al., 2008:640). Following the author, one could admit, that the energetic basis of agrarian societies is strongly limited to the use of biomass and thereby certain types of land-use. However, a certain maximum of energy that can be provided from these systems cannot be exceeded even under favorable conditions (Krausmann et al., 2008).

**Sustainability in the agrarian regime**

Some important sustainability problems\textsuperscript{5} of the agrarian regime shall be mentioned in this section. The enduring relevance of these problems also for the contemporary context of this study, are outlined here:

> "The maximum amount of primary energy that can be produced per unit of land and, hence, the number of people who can be sustained under the conditions of the agrarian regime are limited by the ecological constraints of low-input agriculture. In the absence of external energy subsidies and off-farm resources, the maintenance of soil fertility has to rely on a complex system of often labour-intensive measures to optimize the utilization of locally available resources" (Krausmann et al., 2008: 641).

Among the ecological constraints in agrarian societies, special interest is given to the condition of the soil needed for the production of food and raw materials. For that, soils have high relevance to assure the continuation of the socioeconomic system and need to be managed in a sustainable way (Krausmann et al., 2008).

Labour is another critical issue in agrarian societies. When population increases and thus the need for agricultural intensification demands an increase of working hours in order to raise the yields, it is claimed that

> "The yield per invested hour of labour declines as intensity of use increases and asymptotically approaches a physical limitation, from which point there is no benefit to be achieved by further intensification" (Marina Fischer-Kowalski et al., 2014b: 29).

It can be summarized that agrarian societies face sustainability problems related to limited availability of primary energy due to a sole dependence on biomass from solar energy, the maintenance of soil fertility in a long-term, and the balance between food supply and population growth.

**2.1.4 The industrial socio-metabolic transition**

After outlining origin, characteristics and limitations of the agrarian regime I will continue to outline major aspects of the industrial socio-metabolic transition, often termed as industrial revolution. However, I want to restate, that this apparently linear historical approach of socio-metabolic regimes, that seem to be clearly contoured in human history, is meant as an analytical frame to understand certain patterns and characteristics of energy regimes. Different socio-metabolic regimes can be often found in a specific context of space and time

\textsuperscript{4} Such as aristocratic landlords, clergy, craftspeople, etc.
\textsuperscript{5} to get more output from the same unit of area
\textsuperscript{5} Sustainability problems understood as threats to agrarian societies for reproducing itself by exchanging material and energy with their natural environment
though in varying extent. The simultaneous occurrence of rural subsistence-based agrarian communities, being influenced by an industrial mode of production from the urbanized centers while using ‘passive’ solar energy fluxes through hunting and foraging might be one example for an overlap of energy regimes in a specific context.

What is the revolutionary aspect of the Industrial revolution, seen from a socio-ecological perspective? The so-called industrial revolution can be characterized by an affluence of energy and its implications for socio-ecological systems:

"In the 16th century a new energy regime emerged, a fossil-fuel-based energy system that supplied society with an amount of energy never accessible before. [...] It caused large-scale ecological and social transformations and continues to spread from the industrial core countries (currently comprising about 20% of the world population) to the much larger rest of the world, at an accelerating speed" (M. Fischer-Kowalski et al., 2014: 11).

Clearly, the process of industrialization has not happened over night. However, it has become the predominant mode of subsistence for industrial core countries and has replaced or substituted conditions of the traditional agrarian regime in many places. M. Fischer-Kowalski et al., (2014) assert that the global era of fossil fuels, seen as main indicator of the industrial mode, hat its origin in European countries of the 16th century. From here the regime started to spread out in the coming centuries throughout the globe. First, this was done by using coal (UK) and peat (Netherlands), before oil became the dominant form of fossil energy, globally after World War II (M. Fischer-Kowalski et al., 2014).

By using fossil fuels increasingly as main energy carrier of societies, a fundamental change has started to happen: "While (slow) technological innovation in the agrarian-regime feeds into population growth, in the industrial regime (fast) technological innovation feeds into affluence" (M. Fischer-Kowalski et al., 2014: 16). This affluence is not only to be understood in economic, but also in energetic terms. The abundance of energy led to an emergence of different technological and economical innovations as this had never been possible before in human history (Sieferle, 2003). The biomass-based mode of subsistence was still limited to a certain area of land, technology and human labour input which allowed only narrow options of growth. Now, being exposed to new and abundantly available energy carriers, these limitations have been transgressed.

"Finally, the industrial sociometabolic regime transcends the limitations inherent in relying on the current flux of solar energy by utilizing fossil fuels, the stock of historical solar fluxes accumulated over millions of years. This allows for an enormous increase in social energy and material use (boosting metabolic rates), for a reduction in human subsistence labour, and for a very different organization of society" (Fischer-Kowalski et al., 2010: 8).

The industrial regime shows changing characteristics since its emergence, which demand for further clarification of the historical processes. Krausmann et al., (2008) mention that in the origin of the industrialization, seen from an energy perspective, coal in the UK was mainly used in households and for some industrial processes. The further acceleration of material and energy use can only be understood considering the main source of energy, combined with a main technology of energy conversion. A technological complex consisting of the steam engine, as well as of the railroad and its new possibilities to transport ore, lead to particular effects of a 'metabolic boost'. In this phase, till the mid 20th century, this transitional process was still dependent on a rural hinterland where food for a growing population was still provided by a low-input agriculture. After WWII another big change happened. The emergence of the technological complex consisting of oil, electricity and internal combustion substituted the former 'set of rules', enabled a full decoupling of fossil energy and human labour, and last but not least, opened the way for the industrialization of agriculture. Putting on the socio-metabolic glasses, this process in agriculture can be described as followed: Mechanical power (direct fossil energy subsidies) and artificial fertilizer (indirect fossil energy subsidies) replaced the traditional organic, solar-based agriculture. A result of this industrialization process was an incredibly strong increase in area and labour
productivity at the cost of energy efficiency (Krausmann et al., 2008). Agriculture has been the main provider of energy under preindustrial conditions and provided food and raw materials also for a non-agricultural population. This agrarian way of subsistence is only possible if the energy produced in form of biomass is significantly higher than the energy invested in form of human labour (Marina Fischer-Kowalski et al., 2014a). This positive energetic return on investment (EROI) in agrarian societies, that resulted from labour-intensive utilization of biomass and was necessary to provide food and raw materials also for a nonagricultural population, got lost in the industrial regime and made agriculture from an energy provider of society to an energy sink (Martinez-Alier, 2011).

"The fossil fuel–based energy system, which relies on the large-scale exploitation of nonrenewable stocks, is thus at the core of the industrial sociometabolic regime. The availability of an area-independent source of energy and the fossil fuel–powered transformation of agriculture from an energy-providing activity to a sink of useful energy are the two main factors that made it possible to almost completely decouple energy provision from land use and the control of territory" (Krausmann et al., 2008:643).

The industrial regime has become a global phenomenon when we think of the linkages that have arisen of global economic activity. Thereby it is important to see, that the material and energetic needs of a society to maintain this regime are not limited to its geographical boundaries and to industrial core countries:

"Even if 'mature' industrial economies have lost the strong momentum of biophysical growth, a high level of energy and material use is maintained. What can be observed in the mature industrial core countries is interlinked with processes in all other regions of the world, regions that dwell at another stage of this transition process or may eventually take a different pathway in a globalized world and with new technological options" (Krausmann et al., 2008:644).

Sustainability in the industrial regime

Sieferle (2003:57ff), identified aspects of sustainability for the industrial regime. For his analysis he differs between four categories to exemplify the theory, which are: (I) Energy, (II) materials, (III) biodiversity and (IV) population.

I Energy: From an energy point of view, the industrial mode is mainly based on nonrenewable, finite fossil energy sources such as coal, oil and gas. Since the beginning of the 19th century, the consumption of fossil fuels is rising exponentially and builds the foundation for the realization of economic and technological innovations of the last centuries. As these resources are finite, the social and economic organization that was co-evolving can also not be sustainable.

II Materials: The author argues that all materials need to be moved by energy flows, which leads, having an abundance of available energy, to a strong increase of material use in industrial societies. In Europe of the early 18th century, 2kg of iron were produced per capita and year, while nowadays production of iron is at around 500 kg per year in most industrial societies. This development shows two particular problems in relation to sustainability:

1) The consumption of resources may lead to a resource scarcity on the long run because the mining is done from diggings with ever-lower ore-grades. To solve this problem there is the possibility of
a) substitution of certain materials;
b) the energy invested could be increased; or
c) gains in terms of efficiency through technological progress (e.g. recycling).

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6 "Energy return on investment (EROI) is a means of measuring the quality of various fuels by calculating the ratio between the energy delivered by a particular fuel to society and the energy invested in the capture and delivery of this energy" (Hall et al., 2014)
2) Secondly, the problem of waste and pollution is brought up. This waste problem becomes prevalent as materials only change their place rather than to disappear and need places to be dumped.

III Biodiversity: Although there is a focus on industrial production in this regime, it is important to mention that the use of biomass is paradoxically higher today than in the agrarian regimes. The industrialized agriculture is altering the natural living conditions in a more profound way than this has happened under agrarian conditions and also leads to a far-reaching extinction of species. The author highlights that we live in a period of significant changes that might be rare even in geological periods of time.

IV Population: The global population increased tenfold since the beginning of the industrial transformation. The author argues that this is the demographic reflection of this all-encompassing process. The availability of materials and energy and the pushing back of competing species, lead to a tremendous growth of population.

The author summarizes that we live in a period of general unsustainability. Loss of biodiversity, explosive population growth and a dramatic increase in materials and energy use cannot be sustained over the long run. What we face today might be rather a transitional process that must lead to a more stable state sooner or later. In contrast to the former regimes, “[...] the industrial system consumes not the energy income of the Earth but its accumulated wealth” (Sieferle, 2001:42). The boost in materials and energy use per capita, driven by this affluence of energy, shows its effects on a global scale. In relation to the agrarian regimes, big differences were identified in the “metabolic profile”, which may give a reference for its sustainability problems seen from a material and energy point of view. Table 1 illustrates some quantifiable parameters that show the extent of difference between the agrarian and the industrial regime.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Agrarian</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Use (DEC) per capita</td>
<td>[GJ/cap/yr]</td>
<td>40-70</td>
<td>150-400</td>
</tr>
<tr>
<td>Material Use (DMC) per capita</td>
<td>[t/cap/yr]</td>
<td>3-6</td>
<td>15-25</td>
</tr>
<tr>
<td>Population density</td>
<td>[cap/km2]</td>
<td>&lt;40</td>
<td>&lt;400</td>
</tr>
<tr>
<td>Agricultural population</td>
<td>%</td>
<td>&gt;80%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Energy use (DEC) per area</td>
<td>[GJ/ha/yr]</td>
<td>&lt;30</td>
<td>&lt;600</td>
</tr>
<tr>
<td>Material use (DMC) per area</td>
<td>[t/ha/yr]</td>
<td>&lt;2</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Biomass (share of DEC)</td>
<td>%</td>
<td>&gt;95%</td>
<td>10% -30%</td>
</tr>
</tbody>
</table>

Table 1: Metabolic Profiles; Adapted from Krausmann et al. (2008:643)

How is such a strong increase possible? Certain characteristics of the industrial regime might be responsible for this particular unsustainable metabolic pattern. Important key factors are identified to be:

“[…] material- and energy-intensive industrial production systems (including agriculture); the installation, operation, and maintenance of large infrastructures (e.g., buildings, roads) and physical stocks (e.g., cars); the high level of mobility of goods and people in a spatially highly differentiated economy; and a high material standard of living (e.g., central heating/air conditioning, electrical household appliances, dietary patterns or tourism activities)” (Krausmann et al., 2008b:644).

Having the far-reaching sustainability problems of the industrial regime in mind, the authors claim, “[...] that a transition to a (more) sustainable state implies a major transformation, on a par with the great transformations in history such as the Neolithic or the Industrial Revolution” (Fischer-Kowalski, 2011: 153).

See debate about the anthropocene: (Steffen et al., 2011; Zalasiewicz et al., 2011; M. Fischer-Kowalski et al., 2014)
2.2 Agricultural land-use change

In the previous chapter I outlined the concept of socio-metabolic transitions with a focus on the agrarian regime and elements of it persisting in a predominantly industrial regime. With a focus on agricultural land-use change and its implications for livelihoods in a rural community, it seems rewarding in the next step to have a closer look on theoretical considerations of agrarian and land-use change. I will start with historical attempts that tried to find general patterns for agrarian change, before entering a more recent discussion, in which land-use seems to be strongly interwoven with socio-economic, cultural and or environmental changes. Opposing classic theories on agricultural intensification, some argue that "successive pairing of Malthusian pressures with Boserup technical leaps is not the only ways in which agricultural transformation can be explained" (Brookfield, 2001:189). The here presented theories stress the limitation of simplistic single factor explanations. In contrast, different perspectives on the topic involving social, economic or political factors are discussed, integrated and amplified.

First (2.2.1), I present classical theories on agrarian change with a focus on demographical patterns. Thereafter (2.2.2) I focus on more recent theories that highlight the complex and interrelated character of land-use change. I will point (2.2.2.1) on socio-metabolic transitions on a local scale where scholars identified hybrid-situations that emerge between elements of agrarian and industrial regime and close this chapter (2.2.2.2) with a presentation of interconnected causes of land use change that were extracted from a huge number of place-based case-studies around the world. Concerning this Thesis, I want to accentuate that these general patterns may help in understanding agricultural land-use change. But nevertheless, I argue that an understanding of the unique local context and its variables is essential in getting a picture of land-use change (Lambin et al., 2001) or, as Brookfield (2001:189) expresses it, that circumstances for agrarian transformations are seen as "in all cases peculiar to the place and time".

2.2.1 Agricultural intensification – Malthus, Boserup and the role of population growth

Different strands of thought became popular in explaining agrarian change over the last decades. In many studies, population pressure is seen as a key point of agrarian change. Two main schools of thought can be found here: The Malthusian / Neo-Malthusian and the Boserupian school of thought (Snyder, 1996) both of which emphasize the role of population growth. The political economist Thomas Malthus did a fundamental work on the actual discussion of agricultural change in 1789, focussing on two main variables:

"I think I may fairly make two postulata. First, that food is necessary to the existence of man. Secondly, That the passion between the sexes is necessary and will remain nearly in its present state" (Malthus and Flew, 1985:70).

He points out in „An Essay on the principle of population“ that the subsistence or food production for man is growing with an arithmetical ratio, while population, if not checked, increases geometrically (Malthus and Flew, 1985). Following this thought, the assumption would lead to a ‘population trap’ at one point in time where the food produced under the existing carrying capacity would be insufficient for a relatively faster increasing population. This view on population, being the dependent variable of food production, imposes the idea of a closed system with inflexible external limits (Lambin et al., 2001).
2.2.1.1 Population, technology and environment

Answering to that, the Danish scholar Ester Boserup carried out a very influential work in the field of agrarian change and development responding to the theory of Malthus and his successors. Among other things, the author looked at the interrelationship between population, technology and environment from an economic perspective. She argues in contra to dominant economic theories so far: “population growth is here regarded as the independent variable which in its turn is a major factor determining agricultural developments” (Boserup, 1993:11). In other words population is not reacting to an increase in agricultural technology to produce food, but rather that population (density) is a main factor to stimulate change in technology and the mode of subsistence. Generalizing this theory, the author claims that “[...] agricultural developments are caused by population trends rather than the other way round [...] not only in the special and obvious case of the two decades since 1945, but in agricultural development generally” (Boserup, 1993: 12).

Boserup presented a framework of main subsistence systems in, as she calls, “primitive societies”. This framework comprises five different systems⁸ that are distinguished among each other through their period of fallow-time for the cultivation of food. Following these stages they represent a proceeding of intensification in agricultural production, each stage providing to support an increased carrying capacity for a higher number of human population under certain environmental conditions. These stages are:

1. Forest fallow: 1-2 crops, followed by 25 years of fallow
2. Bush fallow: 4-6 crops, followed by 8-10 years of fallow
3. Short fallow: 1-2 crops, followed by 1-2 years of fallow
4. Annual cropping: 1 crop a year with a few months of fallow
5. Multi cropping: two to three crops a year with no fallow

(Boserup, 1993:15f)

“The number of persons who can live in a given area of land is, of course, higher the shorter the period of fallow. It is not possible to use all the subsistence systems in all environments, but most environments are adaptable and allow a choice between several of these systems” (Boserup,1976:25).

Together with these subsistence systems, different technologies emerge. From land-using strategies like food gathering with simple tools such as sticks, culminating in so-called land-saving strategies for intensive agricultural production. These more intensive systems usually go together with the usage of ploughs, draught animals and or irrigation systems for annual or even multi cropping systems (Boserup, 1976).

Concerning environmental questions, the theory claims that high population density may lead to environmental deterioration and problems of food support for a community. “If the population using one of these subsistence systems increases (by natural growth or by immigration) to the point of exceeding the carrying capacity of the land under that system, the environment is likely to deteriorate” (Boserup, 1976:25).

But, and this is crucial, the population pressure can also lead to a change in the subsistence system. Driven by a higher population density, a change in the mode of subsistence can thereby go together with an adaptation in available technologies by the means of going beyond the current carrying capacity (Boserup, 1976). Subsistence communities, one could argue, are therefore able, at least to a certain extent, to cope with pressure by developing new technologies and new ways of living. The arguments might suggest that: “necessity is the mother of invention”.

Labour is another important aspect of the theory, and for questions about agricultural land-use change in general. Assuming a relationship between labour and technology, the author argues that the introduction of

⁸ Before the Forest fallow the author assumes that the passive form of food gathering was practiced (Boserup, 1976:25)
new technologies was hardly a question of real inventions, but most likely of diffusion from one group to the other. This leads us to the question: "[...] why did small groups of people who live in regions of very low population density and use primitive land-using subsistence systems never adopt the better technologies that were used by other peoples with whom they have been in contact?" (Boserup, 1976:27). This is a pivotal question, also relevant for different still existing systems of shifting-cultivators or people practicing long-fallow systems. A main answer to that question given by the author is that land-using strategies, such as food gathering and long-fallow systems, are better off according to food output in relation to labour input. People who use land in this way have little incentive to change to a 'better' technology as this would mean increasing labour inputs and declining labour productivity (Boserup, 1976). However, there must be a reason why agricultural intensification comes to happen. The omnipresent factor of population pressure is used here as a starting point to explain this process:

"[...] as population pressure in groups of food gatherers and hunters gradually make the environment in which they live less productive, they may react by adopting an alternative technology, which was already known but had hitherto been little used. This new technology will increase the carrying capacity of the environment but will probably lower labour productivity" (Boserup, 1976:28f).

2.2.2 Beyond Boserup - contemporary studies on land use change

The Boserupian framework was and is very influential for different, often interdisciplinary scholars in fields of geography, agrarian change or development studies (Netting, 1993; Snyder, 1996; Ali, 2007; Marina Fischer-Kowalski et al., 2014b) in the last decades. Nevertheless, voices were raised that emphasized the narrowness of this theory, arguing that a range of different factors would rather have an important stake in explaining contemporary land-use change (Brookfield, 2001; Lambin et al., 2003).

The Boserup model is seen as a one-way process, only focusing on two main factors, which are namely the focus on population growth and the need to combat land degradation with respect to soil loss. This two factor model is seen as reductionist by Brookfield (2001). The author argues that the model tended to become a deterministic template of a "step-wise transition from less to more intensive forms of land use" (ibid: 182). The reality, the author claimed, is more complex including constant adaptation to varying biophysical, social, demographic, economic and political conditions.

"Change is the normal condition, but it is in no one direction nor along any one dimension. The labour-intensification of a production system is only one of several possibilities, and labour is only one dimension" (ibid: 182).

The author argues that the world is constantly changing and that rather adaptation, innovation and the seeking of opportunities are indicators for successful change. Another point of critique derives from the Viennese school of social ecology. The Boserupian model would largely ignore factors that are related to the, above mentioned, industrial regime, such as market forces or tremendous increases in labour productivity that are enabled by fossil fuel based technology, that changed profoundly many of the constraints of agrarian society (Fischer-Kowalski and Haberl, 2007).

So far I tried to outline the concept of socio-metabolic transitions as a concept of universal history and put a focus on the agrarian as well as the so-called industrial regime. After that I introduced the Boserupian model as an opposing view on Malthusian/Neo-Malthusian standpoints, and showed some points of critique that were raised, claiming in different ways, that the theory would be too simplistic and deterministic to explain present cases of agrarian land-use change. In the next section I will start with an attempt that uses the aforementioned

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Footnote: 9 For shifting cultivation in Bhutan see Roder et al. (1992)
concept of socio-metabolic transitions to explain sustainability transitions on a local scale. After that I will continue to present a comprehensive study, in which scholars tried to distil causes of land-use change from a variety of local case studies around the world.

### 2.2.2.1 Socio-metabolic transitions on a local scale

The framework of socio-metabolic transitions, apart from explaining qualitatively different regimes in human history according to their main energy and energy conversion technology on a higher system level, was also adapted to explain socio-ecological transitions on a local scale, searching for sustainable pathways of society-nature interactions in rural subsistence communities. The model of Boserup, as outlined above, serves thereby as a point of departure, where the assumption of agricultural intensification defined as increasing land productivity by declining labour productivity was tested by the authors. Different studies have been conducted using the framework of socio-metabolic regimes in different geographical and regime settings (Grünbühel et al., 2003; Ringhofer, 2010; Singh and Grunbuhel, 2003). On the one hand the authors come to the conclusion that the core thesis of Boserup, which says that agricultural output per unit of area rises with increasing population density, while labour productivity was said to decline by that means, holds true for traditional subsistence communities. But on the other hand that the theory loses its ground once the rural communities become dependent of using fossil fuels as an important input of energy, as the use of this input leads to a saving of labour (Marina Fischer-Kowalski et al., 2014a).

"This theory, though, supposes that it makes a fundamental difference if societies base practically all of their processes on solar energy, its conversion into plant biomass and, consequently, an agriculture as the key energy supply sector, or if they base their processes on fossil fuel energy sources - this is a qualitative leap beyond what Boserup introduces as gradual distinctions" (Marina Fischer-Kowalski et al., 2014a: 23).

Taking the increasing interference of the industrial regime into consideration, (Fischer-Kowalski et al., 2010:12) raise concerns to reflect the influence of a fossil-fuel driven industrial mode upon traditional subsistence communities. These points may have an impact on the 'metabolic profile' of the local community, the time use profile and the social organization:

- **Provision of Services**: Medical and educational services are mentioned here as potentially important. While medical services might change the demographical dynamic, the educational service is pointed out as being known only since the dawn of industrialization. From a historical perspective, schooling, is argued, was established neither in hunter-gatherers nor in agrarian rural communities.

- **Regulatory mechanisms**: Legal instruments and market conditions are mentioned as examples for regulatory mechanisms that are put in place by the state and might help local communities to defend themselves against difficult framing conditions.

- **Supply of fossil fuel based technologies**: An important and yet maybe often overseen point is that, even if farmers of rural communities do not use fossil fuels directly, there might be an indirect impact of the fossil fuel-driven regime, for example by the construction of transport infrastructure. "Once there are a road, or a ship line, opportunities for marketing produce, buying commodities from outside, and for labour migration, exchanges with the outside world will greatly increase, and this will modify the local production and consumption patterns" (Fischer-Kowalski et al., 2010: 12). Apart from that, the connection to an electricity network, TV, Radio, and Internet are claimed to strongly change the

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10 Intensive rice farming in Thailand; shifting-cultivation in Bolivia or hunting and gathering on the Nicobar Islands
11 Such as chemical fertilizer based on fossil fuels or the indirect use of external energy inputs for the construction of roads
cultural conditions. And last but not least, development policies may supply fossil fuel based technologies such as mineral fertilizer or pesticides. These conditions are said to create a kind of "socio-metabolic hybrid situation" on the local level.

- **Supply of specific aid and subsidies:** With regard to local study experiences, the authors mention the possibility of subsidies and aids, even if only given in times of extremes, that may strongly change the way the local system works and may lead to an imbalance and discontinuation of the former regime.

The here presented perspective indicates that a socio-metabolic transition might have important implications for the questions of agrarian change, on a global as well as on a local level. The 'underlying' level of the industrial regime seems to fundamentally change the way of metabolic exchange between people and their environment, thereby raising important questions of sustainability. Fossil fuels that are influencing agrarian societies in a direct (e.g. fuel) or indirect (e.g. roads, fertilizer) manner should be taken under consideration when it comes to questions of agricultural land-use change on a local level.

2.2.2.2  Land-use change

Lambin et al. (2003) see land-use change as an element of complex adaptive systems and present an explanatory framework that provides an elaborated inventory of causes for land use change:

"Land-use change is a spatial property observed at the scale of a landscape. It is the sum of many small, local-scale changes in land allocation that reinforce or cancel each other. These changes are the product of multiple decisions resulting from interactions between diverse agents, who act under certain conditions, anticipate future outcomes of their decisions, and adapt their behaviors to changes in external (e.g., the market) and internal (e.g., their aspirations) conditions. In most cases, these decisions are made without central direction, unless there are central planning systems. Land-use change is thus a complex large-scale spatial behavior that emerges from the aggregate interactions of less complex agents" (Lambin et al., 2003: 227).

The framework presented in the following sub-chapter is a distillation of a large number of case studies compiled together to get a better understanding for proximate and underlying causes of land use change. As it would go beyond the scope of this thesis to present all findings of the comprehensive study about causes of land-use change I will present an extract of the findings that seem to be of special interest to comment the empirical findings of this study.

**Multiple causes**

Land use change, as it was already claimed, derives from multiple causes that were found in place-based case studies to explain land use change. On the one hand natural factors, and on the other hand socioeconomic factors are found to happen synchronously yet independently in causing these changes. A combination of more gradual driving forces, together with trigger events, such as biophysical (e.g. climate change) as well as socioeconomic (e.g. economic crisis) are claimed to cause change (Lambin et al., 2003: 217).

**Natural variability**

Biophysical factors are seen as much important as human causes to drive land-use change and depend strongly on local conditions that predispose the natural capacity for land-use changes (Lambin et al., 2003). Examples for natural variability on land-use change are various, including biophysical capacities like soil, climate etc. but its empirical examination play a subordinate role in the here presented context with a focus on individual decision making and external driving forces within a socio-ecological transition.

"Natural environmental change and variability interact with human causes of land-use change. Highly variable ecosystem conditions driven by climatic variations amplify the pressures arising from high..."
demands on land resources, especially under dry to sub-humid climatic conditions. Natural and socioeconomic changes may operate as synchronous but independent events” (Lambin et al., 2003: 217).

Economic and technological factors

There is a wide range of economic and technological factors that influence or cause land use change in human-environmental systems. Under the time frame of a couple of decades or less, it is said, “land-use changes mostly result from individual and social responses to changing economic conditions, which are mediated by institutional factors. Opportunities and constraints for new land uses are created by markets and policies and are increasingly influenced by global factors” (ibid: 218). First, economic factors and policies, such as taxes, commodity prices, subsidies, production and transportation costs, capital flows, investments, access to credits, trade and technology highly influence decisions for land use made by farmers.

"Markets trigger commercial intensification of agriculture in a commodification pathway. Investments in crops or livestock modify the factors and value of production per hectare. Economic differentiation, wage labour, contract farming and other adjustments follow. This pathway is linked to external sources of demand and its sustainability is tied to the vagaries of the market. Collapses in product markets and/or subsidy programs supporting these markets trigger collapses or changes in production systems” (Lambin et al., 2001: 265).

Lambin et al. (2003) highlight in this regard that the access to markets is made largely available by state investments in transport infrastructure (e.g. roads). According to economic factors, the unequal distribution of wealth among households, regions or nations is said to affect the differentiation of opportunities and constraints (ibid). To which extent it is enabled to adopt new technologies that increase the land and labour productivity is thereby strongly affected by these factors. Finally, another point is that an improvement in agricultural technology in combination with secure land tenure systems and the access to credits and markets might be rather responsible for an increased pressure on forests than of relieving this pressure (ibid).

Demographic factors

"At longer timescales, both increases and decreases of a given population also have a large impact on land use. Demographic change does not only imply the shift from high to low rates of fertility and mortality (as suggested by the demographic transition), but it is also associated with the development of households and features of their life cycle. The family or life-cycle features relate mainly to labour availability at the level of households, which is linked to migration, urbanization, and the breakdown of extended families into several nuclear families” (ibid: 218).

Households respond in a strategic way to economic opportunities and constraints. Thereby the life-cycle features affect both rural and urban environments and shape the pathway of land-use change that might in return affect the economic status of the household. Therefore, the authors argue for a detailed analysis of the population (ibid). Migration as being a complex phenomenon per se, is seen as the most important demographic factor causing land-use change at timescales of a couple of decades together with other factors, such as government policies, economic integration, changed consumption pattern and globalization (ibid). Urbanization is also linked to migration and leads to the transformation of land-use elsewhere. Urban agglomerations may create new markets for crops and livestock, while they provoke increasing remittances that are sent back to the countryside where they subsequently change land-use (Lambin et al., 2003).

Institutional factors

Institutions, in the form of traditional, legal, economic or political institutions cause land-use change and operate on a local or national level. Land managers have different access to institutions that are important for access to labour, land, capital or technology. The following institutions are mentioned to represent important non-market institutions for land use:
"property-rights regimes; environmental policies; decision making systems on resource management (e.g., decentralization, democratization, and the role of the public, of civil society, and of local communities in decision making); information systems related to environmental indicators as they determine perception of changes in ecosystems; social networks representing specific interests related to resource management; conflict resolution systems concerning access to resources; and institutions that govern the distribution of resources and thus control economic differentiation" (ibid: 220).

The authors claim that institutions need to be taken under consideration on various different scales. It is important "to identify the local mediating factors and adaptive strategies as well as their interactions with national- and international-level institutions" (ibid: 220). According to policies that might influence land-use change, the authors collected a huge variety of different causes found in the literature that show the complexity and diversity of policy interventions regarding land-use change. These are:

"state policies to attain self-sufficiency in food; taxation, fiscal incentives, subsidies, and credits; price controls on agricultural inputs and outputs; decentralization; infrastructure support; (low) investments in monitoring and formally guarding natural resources; resource commodification; land consolidation, nationalization, and collectivization; structural adjustment measures; and international environmental agreements" (ibid: 220).

The institutional causes affecting land-use issues shift increasingly from a local to a global level due to global market integration and global environmental conventions. Additionally to that, the authors found that land degradation is more severe in cases where macro-policies of each kind undermine local adaption strategies. Taking this into account it is important that rules, used for making policies, are important to ensure that local users are able to influence resource-management institutions (ibid).

Cultural factors

"Numerous cultural factors also influence decision making on land use. Land managers have various motivations, collective memories, and personal histories. Their attitudes, values, beliefs, and individual perceptions influence land-use decisions – for instance through their perception of and attitude toward risk. Land-use decisions have intended and unintended consequences on ecosystems; these depend on the knowledge, information, and management skills available to land managers" (ibid: 221).

Political or economic inequalities affect the access to resources. Therefore, it is said that the understanding of actors’ perception on land use may help to explain the management of resources, their strategies to adapt, their dealing with policy interventions etc. concerning land-use change.

Globalization

While it may seem difficult to frame the concept of globalization in the here mentioned context, the authors accentuate its increasing role for the issue of land-use change:

"[...] cross-cutting the local and national pathways of land-use/cover change are the many processes of globalization that amplify or attenuate the driving forces by removing regional barriers, weakening national connections, and increasing the interdependency among people and between nations" (ibid: 221).

Globalization is not seen as a driver per se, but underlies causes / driving forces mentioned before. On a less proximate level, globalization accelerates or buffers the drivers of land-use change. Globalization and international trade may both be a highly destructive cause of land-use change and environmental degradation in certain cases, while it was found in other cases to improve environmental conditions (ibid).
3 Methods

This chapter explicates the methods used for the here presented study. First I will refer back to the objectives of this Thesis in order to recall its aim in relation to the methods used during this work. Objectives are:

- To describe livelihoods and decisions, taken by farmers in Tashithang, in order to sustain their living.
- To describe important drivers of change and how they are interconnected with farmers’ decisions.

This chapter is structured as followed: First (3.1) I present the focus of the literature review that was done before the empirical fieldwork. After that, I outline my methodological approach of focused ethnography (3.2). It served as my guiding approach, comprising different methods and tools for data collection that were used during the field research. Namely main methods have been: (3.2.1) Participant observation as the heart of the approach, (3.2.2) semi-structured, as well as (3.2.3) ethnographic interviews. In chapter 3.3 I explicate data analysis as an integrated part of the research process. Chapter 3.4 is about research partners in the field. I will close this chapter (3.5) with reflections on methodological limitations and constraints of my research.

3.1 Literature review

A literature review was done before the empirical research in Bhutan to give first insights into the field of interest. It should deepen the understanding of agricultural land-use change in general and with special regard to the case of Bhutan to identify crucial aspects. The objectives of this review were the following:

- To get a general overview about widely spread theories explaining agricultural change.
- Describing the main characteristics of the traditional land-use system in Bhutan with an emphasis on the district of Dagana.
- To get an overview about the historical co-evolution of the agricultural land-use system in Bhutan since the 1960s.

The consultation of relevant literature continued after the empirical fieldwork. New aspects that arose during the field study were integrated into the body of literature and were used in a later step to be interrelated with the empirical findings to form this Master Thesis.

3.2 Short-time / focused Ethnography

The starting point for the methodological framing of this Thesis was the peculiarity to study conditions of land use change in a foreign, unknown cultural context. Additionally, to that, the time frame of the field study was limited to around 12 weeks. Time plays an important role when it comes to ethnography and while "most basic anthropological research is done over a period of about a year, [...] a lot of participant observation studies are done in a matter of weeks" (Bernard, 1994:139). However, the author points out that time does make a difference when it comes to anthropological research. Before pointing at these particularities of my approach, I want to give an outline of the concept of (focused) ethnography and some important aspects for this study.

What is ethnography? Ethnography as such is not a method, but can be rather seen as an integrated research approach that combines different methods, such as observations, interviews, technical recordings or the collection of documents (Breidenstein et al., 2013). Ethnography, can be said, tries to understand cultural phenomena out of their specific context. The personal exploration of living spaces, often called field research, is thereby seen as the central methodological approach for which two features are especially important: First, it is the sensual directness, with the aim to get first-hand experiences of social reality. The second feature is the
permanence of the contact. This refers to the durability of the studies that are usually done over a longer period of time in contrast with other research approaches (Breidenstein et al., 2013). There is no restriction to a specific type of data. Driven by the opportunities of the particular field, it is usually a combination of different types such as protocols, diary, interview protocols, video takes and so forth. Important to mention is, that this combination of data types is not to make the phenomena that are observed less complex, but rather to increase the level of complexity. The data types should be arranged in a way of commenting and complementing each other (Breidenstein et al., 2013).

Due to the specific framing conditions of being in a different cultural setting with a time limitation it was necessary to set a specific focus for this present study. This was done by choosing a short-term approach. Thereby the research methodology can be seen as being inspired by ethnography as cultural anthropology in the sense of studying a certain topic of interest in a foreign culture, as well as by a form of sociological ethnography, termed “focused ethnography” by (Knoblauch, 2005) that is:

“[…] a peculiar form of ethnography, it is characterized by relatively short-term field visits (i.e. settings that are "part-time" rather than permanent). The short duration of field visits is typically compensated for by the intensive use of audiovisual technologies of data collection and data-analysis. Length (extension) of data-collection as it is common in conventional ethnographies is substituted for by the intensity of data-collection. In addition, the lack of intensity of subjective experience in conventional ethnography is compensated for by the large amount of data and the intensity and scrutiny of data analysis." (Knoblauch, 2005)

I chose the approach of short-time or focused ethnography because of three main reasons: First, it was important for me to shed light on this process out of its place-based, specific context, which made empirical fieldwork necessary. Secondly, this approach provides a relative openness of the field research that is characteristic for qualitative research as such. Finally, it offers a large variety of different methods or techniques that allow for a high flexibility in reacting to needs and demands of the particular field.

3.2.1 Participant observation

Participant observation can be seen at the heart of ethnography (Breidenstein et al., 2013) and formed the base of my empirical research in the project area. Participant observation "involves getting close to people and making them feel comfortable enough with your presence so that you can observe and record information about their lives" (Bernard, 1994:136). When we hear the term of participant observation it might easily mislead us to an understanding that it is about a method, which is merely based on visual observation. But, as Breidenstein et al., (2013) emphasize, it does not only mean to observe something in a pure visual sense but it means that observation includes all forms of perception under a participating attendance. Observing means to use all body senses of the researcher including the "social sense". To keep it simple and complex at the same time, participant observation can be described as followed: “The ethnographer participates overtly or covertly, in people’s daily lives for an extended period of time, watching what happens, listening to what is said, asking questions; in fact collecting whatever data are available to throw light on the issue with which he or she is concerned” (Hammersley and Atkinson, 1983:2).

3.2.2 Semi-structured Interviews

Semi-structured interviews were used as a main tool during the research process and were conducted with three different groups of village representatives (I), experts (II) and farmers (III), using different approaches according the level of structured interview guidelines.
Dannecker and Englert (2014) point out, that semi-structured interviews show particular characteristics. First, having a pre-structured guideline might help to compare the answers of the interview-partners afterwards, as they all follow a certain consistent structure. Secondly, if time is limited, it can help to stay inside a certain time frame. However, semi-structured interviews are still flexible. The utilisation is not straightforward and can be adapted according to the interview situation.

(I) During the first phase of the research, interviews were conducted with village heads and representatives of the critical watershed area according first general assumptions around land-use change and rural livelihoods. 8 village heads or representations of them, as well as 7 extension officers of three different administrative units (geogs) have been interviewed in this first stage. The majority of these interviews were done with the help of an interpreter and the interviews were analysed and compared parallel during the first two weeks. This procedure was followed to get an overview about the critical watershed and particularities among the villages. It was furthermore used to provide decision guidance for further research in the geographical area.

(II) As a second group, 6 experts of different fields were interviewed. These interviews have been conducted over the whole time of the research, were done at different places in- and outside of the project area and have even happened unplanned or became interesting after some time. The expert interviews were entirely held in English, which made it much easier to discuss central points of interest. Experts that were interviewed are, (1) Kezang Tshomo, the programme director of the NOP (National Organic Program) of Bhutan, who is working on an implementation of the organic program in Bhutan. Furthermore, local RNR extension officers, installed by the Bhutanese government, in charge for forest (2), agriculture (3) and livestock (4) have been interview partners at the local level in Gesarling geog. An expert interview was held with a young extension officer (5) in charge for a private company to monitor and support the plantation of newly introduced hazelnut cultivations and finally an expert from RNR-RDC Yusipang (6) related to the field of agriculture.

(III) Farmers of Tashithang present the third group of interviewees. Interviews with farmers were done in the last phase of my research process. In that way, living in the community for some time and gaining insights into natural and human causes for land-use change, helped me to get a better understanding about livelihoods and influencing conditions. In that way, I assume that the topics that were discussed during the interviews could gain higher relevance for the interview-partners by avoiding a typical problem of interviews that arises with a lack of understanding of the local context (Breidenstein et al., 2013). 11 farmers of Tashithang, mostly male head of the farms and in respective cases together with their spouse agreed to join interviews about their perception on agricultural land-use and changing livelihoods. The number and specific selection of these farmers was not fixed from the beginning. I selected the interview-partners step-by-step, according to new insights, personal recommendations and upcoming aspects I wanted to shed light on. The arrangement of the interviews was done with the help of local informants, primarily the village head of the chiwog, who was an important door opener. The main part of the interviews was undertaken in homes of the interview partners during the evening time. In few cases, a local grocery store in Tashithang was selected as neutral space for interviews. The interviews were partly held in English and in local languages such as Nepali as well as different caste dialects depending on the capacity of the interview-partners to communicate in English. For the interviews held in Nepali and in local dialects I asked for the help of interpreters who lived in the community. All semi-structured interviews apart from the talks to village representatives in the first stage have been recorded with a digital voice-recorder.

For the realization of interviews with farmers (see Appendix 11.2) and village representatives (see Appendix 11.3), a guideline with questions was prepared beforehand and was adapted according to new insights during the field study. In the case of expert interviews I used a less structured ad-hoc approach of semi-structured interviews that can be termed as problem-centred interview (Witzel, 2000) where I started without a clear guideline but with a more general question of interest (e.g. land-use change and organic agriculture in Bhutan) and practiced a more contained attitude towards the interview partners to get the chance to learn something I did not anticipate about the topic before. The heterogeneity of experts and unexpected interview situations that arose during the field research demanded for such an open and situation-specific approach.
Interviews with farmers and experts were assigned with individual codes, consisting of upper case letters (‘F’ for farmers and ‘E’ for experts) and serial numbers (1-10) to relate quotes and information in the result section to the respective interview partner (see Annex 11.1). Data from farmer and expert interviews were used in chapters 4 and 5 and are quoted as followed: (Code [e.g. F6], Form of Data [e.g. Personal interview, Personal observation, etc.], Date of interview). Data from interviews with village representatives and RNR extension officers during the first phase of research in the project area are quoted in the following way: (rep (village block/geog), Form of Data, Date of interview). Additional data gathered during informal or ethnographical interviews are quoted by using an anonymized abbreviation of the interview partner, form of the communication, and date.

3.2.3 Ethnographical Interviews

Ethnographical interviews, also known as informal talks or unstructured Interviews have been another frequently used technique for data collection. Distinct to the formal interviews that were arranged and pre-structured, Bernard (1994:208) says that: "We interview people informally during the course of an ordinary day of participant observation […]". The method is furthermore characterized as a stand-alone talk where the ethnographers are not only throwing one question after the other in front of the interviewees (Breidenstein et al., 2013). This method was a widely used technique during the fieldwork with numerous interview partners as I found that the confidence and willingness of people to share their perceptions during informal talks are often higher compared to a formal, semi-structured interview.

3.3 Data Analysis

The process of data analysis "[…] starts when the analyst begins to notice, and look for, patterns of meaning and issues of potential interest in the data – this may be during data collection" (Braun and Clarke, 2006:15). For the analysis of my data, I followed an approach that comes close to what (Braun and Clarke, 2006) call thematic analysis. In short terms, thematic analysis is defined as: "[…] a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail " (Braun and Clarke, 2006: 6). According to the authors, this method is widely used but often either confused with another method such as content analysis or not labelled at all. What makes this method of analysis particularly interesting in the case of the present study is that it does not require detailed theoretical and technical knowledge of methods such as for example grounded theory, which makes it a more accessible for novice researchers in the field of qualitative analysis.

3.3.1 Documentation

Written notes from observations and informal talks have been the main source of written documents during the field research. Observations and findings were written down as soon as possible after my experiences. Apart from few special occasions - and when the electricity was cut off - this task was done on a Laptop and took about half of my daily time. Field notes, as mentioned in Bernard (1994) are one elementary part of qualitative data that is collected by ethnographers during their fieldwork. I followed the suggestions of the author during the research and used different kinds of field notes for my documentation. These are (1) Jottings, (2) a personal diary, (3) a log and (4) notes.

1) For Jottings I used small notebooks and pencils that were easy and flexible to handle and take with me. I used the notebook to make quick notes of situations, findings, talks etc. in order to memorize experiences to write extended notes.
2) My diary was surely an essential part of my fieldwork where I reflected personal thoughts, doubts and frustrations that came up during the time in the field. Although I had the comfortable benefit of having a colleague in my neighbourhood, with whom I could talk about personal thoughts as well, the diary was still an important assistance in order to get a distance between the fieldwork and personal thoughts.

3) A log was taken to plan my fieldwork in a systematic way. I tried to follow Bernard (1994) again in his suggestion to take a big log book and use two pages of A4 for every day of fieldwork. On the left side I noted tasks I wanted to execute on particular days, whereas the right page was used to write down what I actually did, all of it as detailed as possible. In this way it was always possible to notice if something was left open and how much my plans and the implementation coincided.

4) The fourth type of field notes are just called notes and can be distinguished in three different types: (a) Notes on method and technique, (b) ethnographic, or descriptive notes; and (c) notes that discuss issues or provide an analysis of social situations Bernard (1994). I tried to establish the same system for my fieldwork. The jottings I have made during the day served for all different kinds of notes and were complementary to support my memory. Most of the notes I wrote down were descriptive notes of the second type. Notes about methods and techniques were taken in a similar way but in far less extent. Finally the third category I called Memos, which are analytical notes where I tried to capture and analyse important points and findings in a more systematic and structured way. These notes were helping me already during the stay in the field to integrate and analyse important aspects of the on-going fieldwork.

Using and generating these documentation sources took substantial time resources. According to Bernard (1994), a researcher should save at least 2-3 hours a day for this work of documentation. Writing Log, Diary and especially generating extended Notes takes time. On many days, especially at the beginning of my fieldwork my day was nearly split into half-time writing and half time "living" which was very important. I tried to write up all the notes as fast as possible and I totally agree to authors of methodical books who emphasize the importance to write up immediately if possible. The quality of the data was far better building them on fresh memories.

**Technical recordings**

Semi-structured interviews were recorded by using a Philips digital voice recorder with a guarantee of anonymization under the agreement of the interview partners. The audio recording made it easier to focus on the interview partners and audio files were saved as soon as possible both on a laptop and additionally on an external hard disk. A digital camera was used to take pictures from the local field site. The pictures were used to contextualize written documents and played a role in memorizing and integrating information of the fieldwork. Although it is clear that pictures have limitations and cannot present an objectified reality, they might help to visualize and thereby underline and comment aspects of the written text.

**3.3.2 Coding and analysis**

"Thematic analysis involves the searching across a data set – be that a number of interviews or focus groups, or a range of texts – to find repeated patterns of meaning" (Braun and Clarke, 2006: 15). After completing the fieldwork, data analysis was done by using MaxQDA software for qualitative data analysis to support the organization of data. However, the software is a tool that cannot substitute thinking processes concerning coding and analysis.

(Braun and Clarke, 2006: 16ff) provide a 6-step guideline how to proceed in data analysis that I followed during my research.
Familiarising yourself with the data

This first phase includes the transcription of verbal into written data and is an important, yet time-consuming, foundation stone for further data analysis (Braun and Clarke, 2006). Data transcription was done partially during the fieldwork and in large parts back on the desk. Transcription of audio-files was done to large extent word-by-word, using the transcription software F5. A small and seemingly less significant part was documented in a descriptive way. The process of transcription for the relevant part was done in two stages. First, I listened to some interviews intensively and then together with the local interpreter and a Nepali-speaking colleague after the fieldwork. In this way, parts of the translation were re-evaluated and, in case of misunderstandings during the interview process, corrected immediately. This double-checking of the interviews, helped to increase the quality of the data considerably. All data was then brought into a written form and was further printed out. Repeated reading of all files was done to get familiar with this data. As (Breidenstein et al., 2013) claim with great justification, that even the researcher who collected the data may have forgotten parts of this information. First notes accompanied this first reading process.

Generating initial codes

After the first phase I started coding my data set. A code is a simple tool of analysis that can be used to assign categories, themes or buzzwords that seem to be of certain interest (Breidenstein et al., 2013). With other words: "Codes identify a feature of the data (semantic or latent) that appears interesting to the analyst" (Braun and Clarke, 2006: 18). In this way, I worked through the whole data set with the help of the software and searched for interesting aspects in my data, which I assigned with different codes. Following the advice of the authors, I coded for as many potential themes as possible.

Searching and reviewing themes

After searching through the whole data set, coding and assembling the data in different ways, it resulted in a long list of different codes. This list was now analysed to find overarching themes among the codes. The list of themes and codes got again reviewed according to their self-consistency on the one hand and in the context of the whole data set on the other.

![Figure 1: Final list of codes after data analysis (own illustration: 12.05.2017)](image-url)
Defining and naming themes / Producing the report

The final step of data analysis was to define and name my themes that were now used to structure my Thesis. After that I started to produce the report in dependence on my codes and themes, trying to set up a convincing story line. However, themes and codes had to be re-evaluated in certain cases during the whole writing process.

3.4 Research Partners

This Master thesis was done in cooperation with the research centre RNR-RDC in Yusipang/Bhutan. The support given to me was valuable according to legal procedures for the research, logistics in terms of transport and accommodation and last but not least, personal expertise before and during the research in the project area. Local research partners were mainly government employees, so called extension officers, who are in charge to advise farmers in the fields of agriculture, forestry and livestock. They usually take care of a certain region and support farmers with their expertise. They facilitated my research process with local knowledge in the field as well as with personal contacts to local authorities. One research partner from the RNR-RDC Yusipang served as a contact person during the research, helping me with different enquiries. Moreover, interview partners, farmers, as well as community members and experts in the field of interests were indispensable partners during the research.

3.5 Methodological limitations and restraints

Time constraints

The time for the fieldwork in Dagana was limited to around 12 weeks. Classical anthropological fieldwork, as already mentioned above, is normally done for a longer period of time. This time restriction demanded a modification of the ethnographic approach towards a focus on questions of agricultural land-use transition and farmers’ livelihoods strategies in my case. Following (Knoblauch, 2005) in his description, short-time ethnography is often termed as superficial by advocates of classical anthropological ethnography. In a certain sense this might hold true for these types of in-depth studies of anthropological monographs, while the author argues that this lack of time is often compensated through another type of intensity in focused ethnographies. [...] “focused ethnographies are typically data intensive. That is, they produce a large amount of data in a relatively short time period [...]” (Knoblauch, 2005). Even with limited time resources, I argue, that the methodological approach, using short-time ethnography was adequate to shed-light on this topic in a particular and enriching way.

Language

Strongly related to the lack of time is the limitation of language, which became a main restraint. At the beginning, the observation in the field was mainly based on visual observation. Due to the fact that many people were not able to communicate in English, oral means of communication remained limited. For though this was a significant constraint, the mutual curiosity among many local people and my person initiated learning of basic language skills in short term. Apart from that, the cooperation with local interpreters and or English-speaking locals helped me to extend my means of communication, which became especially important for the semi-structured interviews with farmers who were mostly not speaking English.

The Interpreter

The searching of the interpreter was one of the crucial tasks for the field research. Only few young, educated people stayed back in the village while the majority has left for education / training etc. outside of the village. Endurance and two trials were needed to find an adequate interpreter due to the low number of potential interpreters on a local level. The role of the interpreter was first of all to translate interviews with farmers from Nepali or local dialects into English and vice versa. Additionally to that, the interpreters, who were all raised on
farms, also served as valuable guides of the local farming system and were helpful to understand phenomena of the natural and social sphere alike.

I belong to
Being affiliated with a project that was set up by a governmental research centre in cooperation with an international partner had its own peculiarities in relation to my research. Especially for the field access it served as a door opener. My person got clearly associated with the RGoB (Royal Government of Bhutan) and the RNR research centre since the beginning. This relation helped me to get immediate support from extension officers as well as from local authorities in the field. On the other hand, my access to the field was pre-framed by this connection, and has certainly influenced the research process as a whole.

Sir
Among the local people, those who achieved a higher education are called Sir or Madam. In the same way representatives are called with this courtesy title. After some time I recognized the ambiguous role that I had in the household. Many people called me Sir as I was coming from abroad and did ‘something, something’ (of which many people did not know what exactly I was doing) in the village. On the other hand I was not familiar with the biophysical surroundings or the farming practices at the beginning. I was not able to speak and understand Nepali and the local cultural customs of the people. I felt like being an "expert" who has the responsibility to bring “the light of development and modernisation” to the village (a role that was given to me many times during the visits of the villages) and on the other hand I felt like a blank sheet of paper without any local knowledge. In many things I was just as clumsy as a small child. Talking local languages, washing clothes by hand, or following cultural and religious customs. Conventional things for locals often became infeasible challenges for me. During the interviews that I undertook in the villages as well as with the farmers I always introduced myself as being a student who wants to learn something about the situation here in the village/the farm etc. It became important for me to lower the expectations farmers and community members had in my presence.

4 Framing the setting: The case of Bhutan

Bhutan is undoubtedly a special case when it comes to the question of sustainability and development. The small country in the Himalayas has become famous for its implementation of the ‘Gross National Happiness’ (GNH) concept and the idea of valuing people’s happiness higher than the economic growth of the country. For the empirical study I have undertaken on a local level, I believe that the ‘larger picture’ is also valuable to be considered. In order to understand land-use change as a process that is rather complex and often leads beyond temporal and spatial boundaries of the local community, some of the trends that are manifested on a local level can be better understood, taking the ecological, socio-cultural and economic context of the larger region into account. Here I want to describe the framing conditions of this small country and the project region, starting with general and geographical information (4.1). After that I will shed light on current questions of sustainability (4.2) in Bhutan and the role of GNH and the "middle-path strategy" as tools to reach sustainable development. Thereafter I will continue with a description of the agricultural sector of Bhutan (4.3). This chapter builds mainly on data from literature as well as on empirical findings during the visit of the project area.

4.1 Country description

Location
The country of Bhutan is located in the eastern Himalayas in southern Asia, sharing borders with Tibet autonomous region of China in the north, and the Indian states of Sikkim in the west, West Bengal in its southwest, Assam in the south, and Arunachal Pradesh in the south-east. It has an extension of 38.394 km², is
land-locked, heavily forested and entirely mountainous with an exception of a narrow strip in the southern belt (SYB, 2016). The topography is one of the most rugged mountain terrains in the world with elevations ranging from 160 MASL in the southern plains to the 7314 meters high mountain Jhomo Lhari (ibid). Geographically the country can be divided into three major areas. The southern foothills, the inner Himalayan valleys and the higher Himalayas (Savada et al., 1993).

![Bhutan Map](image)

Figure 2: Bhutan Map; Source: Rinzin (2006)

**Climate**

The country is divided into three distinct climatic zones: alpine, temperate and subtropical zone (SYB, 2016). There is a high variability in climatic zones. While the southern foothills enjoy a subtropical climate, the high elevations of the Himalayas in the north are snowbound the whole year. Located in the eastern Himalayas, the country gets influenced by the summer monsoon, which is responsible for annual precipitations up to around 5000 mm in some areas. The southern foothills thereby receive the highest amount of rainfall, whereas the higher Himalayas only receive less precipitation of around 500 mm annually (Zurick, 2006). Temperatures vary according to elevations. The central region of the country experiences a cool temperate climate year round while the south is hotter with fairly stable temperature between 15° and 30° C (Savada et al., 1993).

**Biodiversity**

Bhutan is rich in biodiversity. "The complex topography and climate of Bhutan produce a variety of habitats - from tropical to alpine tundra – which, in turn, support a diverse assemblage of biota" (Zurick, 2006: 660). Thereby the country is one of the biological hotspots of the planet counting on more than 5,600 different vascular plant species from which 105 species are said as being endemic to Bhutan whereas close to 200 different mammal species are found in Bhutan with 27 species being threatened on a global level. Biodiversity plays an important role in Bhutan, also due to its attribution as being an agricultural country, which is reflected in a wealth of agro-biodiversity. 6 agro-ecological zones were distinguished, mirroring the great diversity of land-use practices due to the topographic and climatic variability in the country. Around 100 agricultural crops are known in Bhutan with a wide variety of land races according to adaptation to microclimates that change in climate and altitude. Apart from traditional cattle breeds (Bos indicus and Bos taurus), buffaloes (Bubalis bubalis) as well as mithuns (Bos frontalis) and Yak (Bos gruniens) are present (National Biodiversity Centre, 2014).
History
Some prehistoric signs give evidence that Bhutan was already inhabited 2000 BC. The traditional name of ‘Drukyl’ – The country of the Drukpa, the Dragon people, is assumed to exist since the 17th century and derives from the dominant Buddhist sect. The Monpa peoples are seen as the indigenous ethnos of Bhutan, who practiced shamanistic worshipping of nature and believed in good and evil spirits. The introduction of Buddhism in Bhutan was said to have occurred in the 7th century and kind of replaced the former ‘Bon’ religion by absorbing it (Savada et al., 1993). Ngawang Namgyal founded a theocratic government in the 17th century and took the title of ‘shabdrung’, becoming the temporal and spiritual leader of Bhutan. Bhutan got invaded by the British in 1772–73 and signed a treaty of peace that allowed the British to harvest Bhutanese timber, among other concessions. The British became something like the protectors of the Himalayan kingdom until the British rule over India ended in 1947. Competition among regional rivals in Bhutan, finally lead to the victory of Ugyen Wangchuck who defeated his enemies and united the country. In 1907 the 300 year-long shabdrung-system of a dual spiritual and mundane leader came to an end. Ugyen Wangchuck became the first king of the young absolute monarchy in 1907 preceding 4 generations of kings in Bhutan (ibid). This first king (1907–1926) was said to have laid the foundation stone of the development under a central authority (SYB, 2016). The second king Jigme Wangchuck (1926–1952) has continued the modernization and centralization efforts of his father. A National assembly was established in 1953 by the third king Jigme Dorji Wangchuck (1953–1972). This was a big step towards a constitutional monarchy. When the fourth king ruled the country from 1972 till 2006 he brought up the development philosophy of Gross National Happiness, established district and county-level assemblies in 1981 and 1991 and renounced his chair in the cabinet in 1998. Thereby he created the post of the prime minister that would rotate from there on among the cabinet ministers and gave full executive power to the ministers (ibid). In 2001 a royal decree was pronounced that transferred the king’s leadership role to the people to set in a new era of democracy in Bhutan. In that way, Bhutan’s way towards democracy is often claimed as the ‘middle-path’ in which, unlike the European emergence of democracy, the king prepared and transferred the power to the people voluntarily (Masaki, 2013).

Religion
Mahayana Buddhism is the state religion of Bhutan and Buddhists comprised 70 % of the population in the 1990s. The majority of Bhutan’s Buddhists are adherents of the Drukpa subsect of the Kargyupa school, which is one of the four major schools of Tibetan Buddhism, seen as a combination between Theravada (monastic), Mahayana (messianic), and Tantrayana (apocalyptic) forms of Buddhism. The minority, but still important religion, of the country follows the Hinduism, mostly practiced by Lhotsampas of Nepalese origin (Savada et al., 1993). The role of Christians in the country is not easy to be estimated, yet, due to own observations and comments of local representatives in Dagana district, the number of people following the Christian religion has gained a substantial number in Bhutan, especially in its Southern part.

Present political system
Bhutan underwent a rare path in political history, seeing a political regime transformation from an absolute monarchy to a democratic constitutional monarchy, driven by the king, in 2008 (Sinpeng, 2007). The fifth king (Druk Gyalpo or Dragon King), Jigme Khesar Namgyel Wangchuck, is head of the young democratic state, while the executive power is vested in the cabinet. The head of government is the Prime Minister who is elected by the ruling political party. The national assembly consists of 47 members who are elected from 47 constituencies (SYB, 2016). For administrative purposes, the country is divided in 20 Dzongkhags and again sub-divided in so-called Geogs (Rinzing, 2006).

Population
The overall population of Bhutan is still low and was projected from a census in 2005 to amount to 768.577 in the year 2016 (SYB, 2016). Looking at demographical developments in Bhutan, the “predominantly rural and isolated character” (Zurick, 2006:661) of Bhutan has rapidly changed in the last decades. While the urban population accounted for only 5 % in 1980, and 15 % in 1994 (GNHC, 2010), it was found to hold for 30.9 % in contrast with 69.1 % of the population living in rural areas, according to housing census in 2005 (SYB, 2016). The
population growth rate has thereby declined from 3.1 % in 1994 to 1.3 % in 2012 and is projected to decline further. This is mainly due to a strong decrease in total fertility rates, which have fallen from 6 children per woman during the 1980s to 2.6 children in 2010 (GNHC, 2013).

People and Ethnic groups
People in Bhutan consist of four broad different, but not exclusive, ethnic groups (Savada et al., 1993). The Ngalop are of Tibetan origin and have migrated to Bhutan in the ninth century. They comprise the dominant political and economic culture in modern Bhutan. Sharchops comprise most of the population in eastern Bhutan and have migrated to Bhutan possibly from Assam or Burma in the past millennium. For a long time, they have been the largest ethnic group but got partly assimilated into the Tibetan-Ngalop culture. As a third large group in Bhutan, the Lhotsampkas (Southern Bhutanese people with mostly Nepalese origin) are found mainly in the southern belt. The first migrants came to Bhutan in the late 19th and beginning 20th century. Finally, there is a variety of tribal ethnic groups that have come from different parts such as West Bengal or Assam and live in scattered villages throughout Bhutan (Savada et al., 1993).

4.2 Sustainable development and GNH

Bhutan is worldwide known for its ambitious development attempt of the gross national happiness (GNH) concept that follows the notion to value people’s happiness higher than economic growth. In this sub-chapter I want to outline aspects of the Bhutanese development paradigm and its relationship to the internationally widely used concept of sustainable development.

Gross National Happiness
Beyond its borders, Bhutan is strongly associated with the concept of GNH. It is claimed that this concept builds on particular socioeconomic features of Bhutan and a set of Buddhist and feudal values already preceding the advent of modernisation in the 1960s (Priesner, 1999). The concept gained its popularity in- and outside Bhutan later in the 1980s and 1990s with its catchphrase of ‘Gross National Happiness’ and the notion of the fourth King to value people’s happiness measured in terms of GNH higher than gross national product (GDP) (ibid). After that, GNH became a guiding principle of the Bhutanese development planning when it was mentioned in the 8th five-year planning document (Brooks, 2013). GNH can be seen twofold in the actual process of Bhutanese development. On the one hand it serves as the central development philosophy in the country that guides development by building on a holistic framework with four main pillars (Rinzin, 2006: 30):

1. Sustainable and equitable economic development
2. Conservation of the environment
3. Preservation and promotion of culture
4. Good governance

The focus of development was outlined in the vision 2020 document of the Bhutanese government and aims to: [...] achieve a balance between the spiritual and material aspects of life, between peljor gomphel (economic development) and gakid (happiness and peace). When tensions were observed between them, we have deliberately chosen to give preference to happiness and peace, even at the expense of economic growth, which we have regarded not as an end in itself, but as a means to achieve improvements in the well-being and welfare of the people (RGoB, 1999). Apart of being the ‘philosophical guideline’ for development planning, the concept of GNH was operationalized in 2008, culminating in the GNH Index (GNHI) 12. This is a single number index developed from 33 indicators under 9 domains that is used to measure happiness via nation-wide surveys among the population of Bhutan (GNHC, 2013). A survey was most recently done in the year 2015 13.

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12 For discussions on the operationalization of GNH see for example: (Veenhoven, 2004)
13 Findings of the GNH surveys 2010 / 2015 and further information: www.grossnationalhappiness.com
Sustainable Development and GNH

The development philosophy of GNH was also influenced by and is related to the concept of Sustainable development that both promote a harmonious living between nature and society by taking a holistic view beyond economic growth (Rinzin, 2006). Sustainable development is the Bhutanese goal of development with the 'Middle-Path Strategy' as National Environment Strategy to achieve this goal (NEC, 1998). The report of the National Environment Commission (NEC) of Bhutan defined sustainable development in 1998 as: “the capacity and political will to effectively address today’s development and environment problems and tomorrow’s challenge without compromising Bhutan’s unique cultural integrity and historical heritage or the quality of life of future generations of Bhutanese citizens” (NEC, 1998: 28). This 'Middle-path-strategy' as it is called, shows much common ground with the concept of sustainable development. At the same time, it tries to formulate a particular and rather holistic version for the Bhutanese case. The 'middle-path strategy' builds on four main characteristics. These are claimed to be: (I) Balance between materialism and spiritualism; (II) Focus on specific resource potentials; (III) Distribution of responsibilities and (IV) integrated management (Rinzin, 2006: 35f).

4.3 Bhutan’s economy

Bhutan’s economy has changed much since the advent of modernisation. The country has moved from a traditional non-monetized economy to a modern wage-based market economy since 1981 (Frame, 2005). This process of modernization and development in Bhutan has been guided since 1961 through the implementation of five-year-plans (FYP) (ibid). The economic importance of traditional use of natural resources has thereby decreased in relation to other sectors of economy such as hydropower-driven electricity production or tourism. In this sub-chapter I want to give a short overview about the current economic status in the country, and reflect the role of the natural resource sector for the national economy in this agriculture-society, as it is still called in government papers.

Today, Bhutan has lost its isolated character and depends on trade of goods with other countries, especially with India that is the most important trading partner accounting for 84 % of exports and about 73 % of imports (GNHC, 2013). Imports of goods have risen steadily since the 1990s while the exports decline since 2006 after a sharp increase from 2000 onwards (Khan and Robson, 2015). Bhutan has had a constant growth in GDP since the 1990s reaching a GDP/capita of 2378.80 €14 in 2014/2015 with an average annual growth rate of 6.79 % between 1990 and 2014 that has even climbed up to 7.72 % in the years from 2004–2014. This growth is mainly driven by revenues from hydropower electricity exports (ibid). Apart from this, a booming tourism sector and sound macroeconomic politics concerning fiscal and monetary policies might ensure this growth also in the near future (ibid). Sector wise, services, comprising tourism, banking etc. are the strongest contributors to GDP, while the agricultural sector is strongly declining as equally observed in other Asian countries. The Bhutanese economy depends strongly on few strong sectors and a lack of economic diversification was found as a serious challenge for the macro-economy due to a lack of job opportunities for a rapidly growing and educated population in Bhutan (GNHC, 2013).

4.3.1 Agriculture, Forestry and Livestock

Bhutan is often labelled as an agriculture-society, whereas the role of the RNR sector, comprising of agriculture, forestry and livestock, has significantly changed both in terms of employment and of economic importance in the Bhutanese society during the process of modernization and development. Currently, domestic produce guarantees for a modest food security (see 4.3.5 and 4.3.6). According to statistics, 60 % of the cereals,

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14 Current GDP: 132,021.30 Million Nu. (see SYB, 2016), Population number as estimated for 2016: 768,577 (SYB, 2016: 3); actual exchange rate: 1 EUR € = 72.21 Nu. (10.01.2017)
vegetables and animal products that are consumed in the country are produced domestically. The self-sufficiency of fruits and nuts is nearly met with 95 % available in the country, while the production of beef (20 %), fish (3 %), pork (23 %) and oil / fat products (10 %) are far from meeting the country’s needs and lead to a dependence on imports (GNHC, 2013). However, the sector is still the largest ‘employer’ in the country, holding for 62.2 % of the overall labour force in 2012 (ibid). The nominal contribution of the sector for the GDP has doubled from 2001/2002 to 2010/2011 (ibid) while its importance for the national economy has declined by nearly 50 % over the last three decades (Khan and Robson, 2015) holding a contribution of 16.67 % in 2015 (SYB, 2016). This happened mainly because of higher growth in other sectors such as electricity and construction and because of different challenges for growth in the sector itself (GNHC, 2013). In the past, Bhutan tried to put a focus and boost the RNR sector’s growth. However, current growth in the RNR sector alone has been not sufficient to achieve food security, to alleviate rural poverty, and to ensure overall economic growth (ibid). In the agricultural sector, the growth rates are low in spite of the potential for high-value fruit production, accessibility to export markets and extensive governmental support for the sector (Christensen et al., 2012). High growth-rates are found in export crops such as citrus and potatoes whereas the contribution of food staple crops such as maize, paddy, barley or wheat to the GDP is declining strongly. The expansion of the rural road network, meant as a condition for economic growth, leads to a farmers response to increased market opportunities for export oriented cash crops while the availability of cheap imported rice from India may penetrate the goals to raise the self-sufficiency in cereal crops (ibid). Weak marketing institutions are seen as another major constraint that limits commercialization of agricultural products. Further constraints are seen in insufficient use of farm inputs (e.g. low use of inorganic fertilizer and pesticides) and labour shortages (ibid).

4.3.2 Hydropower and Energy transition

The energy system in Bhutan is currently in a transition. According to scenarios built by (NEC, 2012) the final energy consumption (FEC) in Bhutan will generally increase from 0.61 TOE\textsuperscript{15}/capita in 2005 to 0.97 TOE/capita in 2040 with a strong difference among rural and urban areas. Due to rural-urban migration, the final consumption in rural areas is only anticipated to double, whereas the urban consumption will increase by a factor of 14 (NEC, 2012).

Table 2 shows, that the share of fuel wood will lose its dominating role to provide energy for the Bhutanese society. It is assumed in the scenario, that the share will drastically decrease from 60 % in 2005 to only 22 % in 2040, whereas the share of fossil fuels is slightly increasing from 27 % in 2005 to 29 % in 2040 but with a strong increase in absolute numbers from 106 ktoe to 266 ktoe in 2040 (ibid). Electricity shall provide the largest share of energy in future and will make up for 44 % of FEC in 2040 (ibid).

Looking at actual numbers, the total energy consumption already increased to 650,372 TOE in 2014, compared to 388,550 TOE in 2005, of which Biomass (firewood, biogas & briquettes) still dominates, but to a much lower extent, the whole energy consumption in Bhutan constituting for 36 % equal to 234,369 TOE (NEC, 2016). Fuel imports grew on average by 9.19 % from 2011 to 2014, of which diesel constitutes 80 % (ibid).

<table>
<thead>
<tr>
<th>All sectors</th>
<th>Final Energy Consumption</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Biofuel (diesel)</td>
<td>0</td>
<td>43</td>
</tr>
<tr>
<td>Biogas</td>
<td>0</td>
<td>5405</td>
</tr>
<tr>
<td>Briquettes</td>
<td>65</td>
<td>43507</td>
</tr>
</tbody>
</table>

\textsuperscript{15} TOE: tonne of oil equivalent is a unit of energy defined as the amount of energy released by burning one tonne of crude oil.
### Role of Hydropower in Bhutan

Bhutan with its numerous rivers has an estimated potential of 23,760 MW for energy production from hydropower plants (GNHC, 2013) with an installed capacity of 1505 MW in 2010 (NEC, 2012). Four new hydropower plants were planned for the period 2010-2020 with a combined capacity of 3024 MW to be majorly exported to India. With a major share of 14.34% for electricity and water supply for GDP in 2015, hydropower plants contribute fundamentally to the overall GDP growth and economy in the country, both during constructions and operation phases (SYB, 2016). Sales from hydropower are the backbone of the Bhutanese economy now and in the future, which can be also seen by its importance for overall economic growth rates, that depend strongly on hydropower sales (Khan and Robson, 2015). However, the strong economic dependence on hydropower schemes was also noticed as a prevalent risk for Bhutan, making it vulnerable for diplomatic pressures in terms of development from its Indian neighbour in the South (Uddin et al., 2007) and demand for an economic diversification in other sectors (Khan and Robson, 2015).

### 4.3.3 Industry

Bhutan follows generally a high value, low volume approach for goods and services according trade, mining and industry. The industrial sector, including mining & quarrying (3.40 %), manufacturing (7.99 %), and construction (15.61 %) contributed in total for 27 % of the GDP in 2015 (SYB, 2016) and is dominated by few major firms that are based on metals and minerals and are found in the southern part, close to the Indian market, both for raw materials and exports. Apart from that, numerous smaller firms for handicraft, agro-, and wood-processing, construction, paper and textile industries are established in Bhutan. Many of them found in the northern part of the country (GNHC, 2013). The mining sector in Bhutan is as by now relatively undeveloped. Significant deposits of mineral resources like limestone, coal, graphite, gypsum, slate and dolomite can be found that are mostly limited to relatively small operations of dolomite, gypsum, limestone, slate, coal, marbles, quartzite and talc. The extraction is dominated by a small number of major operators (SYB, 2016). Key challenges for the industrial sector, that mainly consists of small and micro industries, predominantly found in urban areas, are said to be lack of capital, technology, markets and labour that result in a low volume and quality of products in combination with comparable high costs (GNHC, 2013).
4.3.4 Tourism

The tourism, similar to the Industrial sector, follows a 'high value-low impact' approach with the aim of minimum impact on the natural and cultural heritage of Bhutan. This is done by regulating tourist arrival via tourism pricing of 200 $ in off-seasons and 250 $ in high seasons (GNHC, 2013). Tourism sector is the major source for foreign exchange earnings and employment. Revenues from the tourism sector have increased in Bhutan from less than 2 % GDP contribution in 1995 to over 6 % in 2013 and make up for 73 million USD in 2014 (SYB, 2016). The tourism industry in Bhutan enjoyed continued growth rate with the tourist arrivals in the country rising steadily during the 1990s through 2000 (SYB, 2016). A huge increase from 6000 tourist arrivals in 2001 to 105,407 arrivals from both, international and regional tourists in 2012 was stated in only one decade (GNHC, 2013). Tourism is seen as a key sector for economic growth, employment opportunities and revenues (ibid). Some key challenges for sector growth include accessibility problems, shortage of manpower of trained guides and workers in the sector. This still leads to a dependence on internationally operated tours. Three domestic airports are currently under construction to solve the problem of accessibility to Bhutan for tourists (ibid).

4.4 Farming in Bhutan

"Given the significance of farming in Bhutanese society and the fact that a rural livelihood, in combination with monastic centers, is the primary repository of cultural traditions, agriculture becomes an important nexus in the country’s efforts to enhance both national happiness and environmental conservation" (Zurick, 2006: 669).

The aim of this section is to describe the agricultural land-use system in Bhutan with a focus on the district of Dagana. First I will give a historical outline and important policy milestones from the 1960s until today. Subsequently the land-use in Bhutan with a focus on agriculture is described in more detail. This is done by pointing on: (I) the role of the forest for the traditional land-use system, (II) the land tenure system in Bhutan, drawing on the Land Act 2007 and empirical findings and (III) land-use types and farming practices, including the livestock system.

The farming system in Bhutan is still largely subsistence oriented and builds on traditional knowledge with low external inputs (Dorji 2008). The farming practice is labour intensive because of very small land-holdings and a particular topography with steep slopes that doesn’t fit well with mechanization (ibid). However, in the recent past, Bhutan is undergoing rapid changes in society including the agricultural land-use system (SYB, 2016). While 90 % of the people gained their livelihoods by means of agricultural production in 1986 (Young, 1991), this share has decreased to 56.7 % in 2014 (SYB, 2016). Its significance for the whole economy has also changed, and the renewable natural resource sector, including agriculture, forestry and livestock, makes now up for 12 % of total GDP (GNHC, 2013).

4.4.1 Historical background and policy milestones

Till the 1960s, when the first five-year plan (FYP) from the Royal Government of Bhutan (RGoB) was implemented, the only research related to fields of natural resources including farming was left to innovative farmers who experimented with new production methods as well as plant varieties and livestock species (Tshering, 2009). The formal development planning in Bhutan started in 1961 with the construction of basic infrastructure of roads, postal service and a public transport system (Young 1991). In this first phase a clear focus was laid on food security through capacity building (Neuhoff et al. 2014). In the 1970s the public sector increased its expenditure for poverty alleviation, environmental conservation, nutrition improvement and
marketing (Neuhoff et al. 2014). In the 1980s the „green revolution” technologies, that showed their potential in other South Asian countries, were introduced also in Bhutan. High-yielding varieties from India (wheat) and the Philippines (rice) were distributed via the Ministry of Agriculture. However, according to Young (1991) this technology wasn’t adequately tested in the fields of Bhutanese farms. Furthermore, there was no provision of the ‘whole package’ of agro-chemicals so that these varieties couldn’t show their full potentials in country. The author mentions that the new varieties gave a slightly higher yield of grain but a far less amount of straw which is an essential part of the Bhutanese livestock integrated agricultural system (Young 1991). Together with the introduction of high-yielding crop varieties of wheat, maize and rice to grow more food, cash crops became another important strategy during the 5th five-year plan (ibid). The aim of this measure was to increase the income of the farming community through diversification of production, relying primarily on cash crops (GNHC, 1981). There was an early warning by Young (1991) related to the introduction of cash crops in Bhutan who argued that unexpected social and physical environmental consequences of these measures would coincide.

The agricultural practices in Bhutan have changed strongly over the last decades. Until ten years ago the agriculture was mainly subsistence oriented which means that the main part of the products was consumed within the households with little surplus for markets (SYB, 2016). Anyway, the self-sufficiency rate of major crops is relatively low today compared with the past. Paddy, which is the dominant food crop in the country, covered 53 % of the grain eaten by the Bhutanese population in 2012. For the whole range of cereals the self-sufficiency rate is higher with a share of 69 % (Dukpa, 2013). According to the food self-sufficiency of the country, Young (1991) noted, that the share of imports of major crops has changed in that profound way only since the 1980s:

<table>
<thead>
<tr>
<th>Imports (million tonnes)</th>
<th>1981/1982</th>
<th>1986/1987</th>
<th>Change in %</th>
<th>2014</th>
<th>Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>2345</td>
<td>11282</td>
<td>381%</td>
<td>79306</td>
<td>603%</td>
</tr>
<tr>
<td>Wheat</td>
<td>873</td>
<td>3350</td>
<td>284%</td>
<td>23264</td>
<td>594%</td>
</tr>
</tbody>
</table>

Table 3: Imports of food crops: adapted from Young (1991) expanded by using SYB (2016: 103)

The actual import of rice in the year 2014 has reached 79306 million tons in Bhutan as shown in Table 3, which is an increase of 603 % compared with 1986/87. The reason for the development in the 1980s was that the government needed to increase the export to generate higher revenues. For that, the government started, supported by foreign aid, to change the economic, subsistence oriented, structures in Bhutan towards a stronger orientation for the market. Measures taken for that comprise the introduction of new plant varieties and a focus on cash-crop production (Young, 1991). However, nowadays there is again a focus on self-reliance in this sector: The three aims of the renewable natural resource sector (RNR) in Bhutan are:

(I) Conservation of the environment,
(II) Enhancement of rural household incomes and
(III) To attain self-reliance of cereals and essential oils (SYB 2013).

The strategies to reach these aims were outlined in the eleventh five-year plan (2013-2018). According to (GNHC, 2013) the strategies are:

(I) Investment in irrigation,
(II) farm mechanization,
(III) electric fencing to ward off wild animals, and
(IV) land development
4.4.1.1 Organic Vision 2020

This subchapter about organic agriculture in Bhutan is based on literature as well as on data from an expert interview with the programme leader of the Bhutanese National Organic Program (NOP) Kesang Tshomo (E1). Bhutan has raised international attention with its vision to become the first country worldwide to produce 100% organic by 2020 (Confino, 2014). In a comparative study of organic agriculture, Bhutan is mentioned to have an area of 20.995 hectares under certified organic production in 2011, which equates with 7.8% of the total agricultural area (Willer et al., 2013). Bhutanese newspaper articles in recent years question the attempt of the country and point on increasing amounts of agrochemicals and fertilisers that were imported to Bhutan, mostly from India, in the last years (Katwal, 2016). The programme leader (E1) of the NOP (National Organic Program) claims that there is much potential to develop organic agriculture in Bhutan. To reach the vision by 2020 has always been a good target but also raises questions and challenges.

The NOP, under the Ministry of Agriculture and Forestry (MoAF), is the focal agency for coordinating and implementing activities for promotion of organic agriculture in Bhutan. It promotes organic agriculture ideally by support, education and awareness building of farmers instead of providing economic compensation (E1, Personal Interview, 28.08.2015). In Bhutan exist a national organic standard but no national system of certification that could evaluate farms and products to be certified as following international organic standards. Products, such as honey, essential oils, tea, spices, herbs and soaps that go for an export market, get a certification by Indian agencies and are exported by the private company BioBhutan (Neuhoff et al., 2014). Generally, Bhutan is focusing on a three-fold path, with a focus on the majority of consumers 'who are happy with organic food without certification' (E1, Personal Interview, 28.08.2015). The largest group of farmers involves groups of farmers or big individual farms that are willing to do organic agriculture without assured certification. They get information and trainings and can further register at NOP to use the Bhutan organic logo to sell products on the national market (E1, Personal Interview, 28.08.2015). These farmers have no financial benefits and therefore no incentives in terms of economic return to produce organic on their fields:

"Those people who have converted or changed is not because of market opportunities, is not because of the premium of organic. Because in Bhutan there is no premium on organic produce. Organic and local produce is at the same price. So that is not an attraction. Because there is no premium on organic there is no reason for people to cheat and say that they are organic when they are not organic, because that will not give them any more money" (E1, Personal Interview, 28.08.2015).

As a second option, farmers can choose to get certified by BAFRA (Bhutan Agriculture and Food Regulation Authority) to get an organic certificate following national standards, which might be needed for the national hotel business. This certification is related to higher efforts for farmers who get inspections by BAFRA staff and have to document their approach in the field to a larger extent (E1, Personal Interview, 28.08.2015). A third procedure is possible for farmers who have products that shall be exported following international standards. This is done mostly by Indian agencies and is related to a much higher effort in terms of financial and time resources. E1 argues that only 1–2% of the whole production would fall into this category. Due to that it would not make sense to build up a whole system for that but rather offer the service in cases needed (E1, Personal Interview, 28.08.2015).

The vision to become 100% organic is undoubtedly an ambitious attempt and raises challenging questions for agricultural land-use in Bhutan:
The livestock system is currently excluded from the organic program of NOP due to challenges in animal health and locally produced feed. NOP needs to involve the whole value chain of livestock, from animal health to feed, etc. before they can enter this field. In the near future, E1 claimed, that they want to start with first pilot projects in this sector (E1, Personal Interview, 28.08.2015).

The official distribution of plant protection chemicals (PPC) (see Table 4) and import of mineral fertilisers (see Table 5) in Bhutan has not declined but even increased in recent years according to statistics, putting a big question mark on the practical reality of the vision for 2020.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dagana</td>
<td>210</td>
<td>62</td>
<td>7</td>
<td>653</td>
</tr>
<tr>
<td>Bhutan</td>
<td>19,730</td>
<td>21,239</td>
<td>23,099</td>
<td>24,576</td>
</tr>
</tbody>
</table>

Table 4: Distribution of plant protection chemicals (PPC) in Bhutan (adapted from (SYB, 2016: 91))

<table>
<thead>
<tr>
<th>Fertilisers (value in Nu.)</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50,997,490</td>
<td>78,956,792</td>
<td>108,559,234</td>
<td>92,430,754</td>
</tr>
</tbody>
</table>

Table 5: Fertiliser import Bhutan (2013-2016) (Sources: (Department of Revenue and Customs, 2013); (Department of Revenue and Customs, 2014); (Department of Revenue and Customs, 2015);(Department of Revenue and Customs, 2016))

According to E1, fertilizer and pesticides are crop-specific in Bhutan and mostly used for rice (herbicides), maize (fertilizer), apples (fertilizer, pesticides), potatoes (fertilizer and pesticides) and citrus (pesticides). Agrochemicals are used in only 5 % of total cultivated land. However, 5 % are still a concern as rice, maize and potatoes, involving a majority of Bhutanese food crops, are grown on this land (E1, Personal Interview, 28.08.2015).

A major concern for the organic program is the use of herbicides, which reduces the labour demand in major crops such as paddy, and cannot be replaced with organic alternatives by now.

“But if the government says, no no no we have to be 100 % organic. We cannot have any chemicals in the country. Stop growing rice. Stop growing Citrus. Stop growing potatoes, or accept the lower yield, or the lower, you know, quality” (E1, Personal Interview, 28.08.2015).

Organic agriculture needs additional labour force in comparison to fossil-driven agriculture that has raised labour productivity by the use of chemical farm inputs and mechanization. Thus, declining labour force in rural areas is also linked to the general trend of rural-out migration that was mentioned by E1 as a severe issue Bhutan shares with many other countries. E1 additionally mentions that young people who return to rural areas would prefer organic agriculture than conventional farming and NOP tries to support them in this direction (E1, Personal Interview, 28.08.2015).
### 4.4.2 Land cover

<table>
<thead>
<tr>
<th>Land-Use Type</th>
<th>Area (km²)</th>
<th>Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>27.053</td>
<td>70.46 %</td>
</tr>
<tr>
<td>Shrubs</td>
<td>4005</td>
<td>10.43 %</td>
</tr>
<tr>
<td>Cropland</td>
<td>1153</td>
<td>2.93 %</td>
</tr>
<tr>
<td>Meadows</td>
<td>1545</td>
<td>4.10 %</td>
</tr>
<tr>
<td>Water bodies</td>
<td>277</td>
<td>0.72 %</td>
</tr>
<tr>
<td>Settlements</td>
<td>62</td>
<td>0.16 %</td>
</tr>
<tr>
<td>Others[^16]</td>
<td>4300</td>
<td>11.2 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38394</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

Table 6 shows that only 7.03 % of the total land area in Bhutan is used for agricultural purposes. The land area for the cropland is even limited to 2.93 % while the rest (4.10 %) is used as extensive grassland (SYB, 2016). In Dagana this share is slightly higher with 4.38 % of the area in the district (NSSC et al., 2011). Land cover distribution is closely related to altitude and differences between regions and districts. However, the composition of the land-cover types, as presented below, will change significantly in future due to an on-going re-cadastral survey and granting of land to landless people, so-called rehabilitation of land (RNR statistical coordination section, 2015).

[^16]: non built-up areas, degraded areas, bare areas, marshy areas and snow cover

### 4.4.3 Land tenure system

The data in this chapter is based on the Land Act 2007 (RGoB, 2007) of Bhutan in addition with participant observation, ethnographical interviews and talks to local village representatives (rep) from local field research in the critical watershed Buedulum Chhu with a focus on Tashithang village and involves critical issues of the land tenure system for the here presented study.

In Bhutan, everybody has the right to get and own private land at a maximum extent of 25 acres (= 10.2 hectare), to make private transactions and lease land, either from private or from government side (RGoB, 2007); (rep (Goshi), Personal Interview, 07.07.2015). An exception of this upper limit of land is for a) members of the Royal family, b) crown property, c) Government institutions, d) Gerab Dratshang, e) Community owning land for social or religious purposes and f) industrial land beyond 25 acres (RGoB, 2007). An authoritative document, called *Thram*, is used to record and establish legal land ownership of a person in the country. The registration of a particular land that results in a *Thram* document is furthermore related to payment of taxes to the RGoB depending on extension and land category (RGoB, 2007).

Besides land ownership, there is the possibility for individuals, but preferably for groups, to lease government land or government reserved forest (GRF) land. According to a local RNR expert, government land is preferably given to groups of people who plan agricultural activities, but can be also given to individuals after a proposal for maximum 30 years (rep (Goshi), 07.07.2015). In the case of leasing GRF land, land may be leased for sustainable use and management to a juristic person including communities, the institution of Monarchy, Government Institutions, Gerab Drathsang, Civil Society organizations, Co-operatives, Corporations and Religious Organizations of Bhutan, Foreign Direct Investment (FDI) companies, & private companies without ceiling of land in case that the requirement of land for an economic activity is seen as appropriate by the National Land Commission (RGoB, 2009). The price for this leasing of government land is Nu.640 (= 8.30 €) / 0.404 ha / year in 2015 (ibid) and can be reclaimed from the government only in case of securing national interests (e.g. road construction) (Informal Interview, 08.08.2015). Shared agriculture is another form of leasing that is practiced by...
farmers in the critical watershed. It means that a farmer cultivates land of somebody else and that the two parties involved share the harvest of the plot between them, depending on local agreements and mutual consent. Earlier, the share between owner and cultivator was mostly 50% / 50%. This is still practiced in Tashithang and Phuensumgang village (both Gesarling geog) which leads, according to a farmer nowadays to fallow land, as people are not willing to conduct hard manual work in the fields at these conditions in times of labour shortage. In Gesarling geog around 5-10 cases are known that practice this form of leasing (E2, E3, Personal Interview, 11.07.2015). In Pungtsi (Kana geog) on the other hand, farmers have decided to share the harvest 75% for the cultivator and 25% for the owner due to these reasons (AS, Informal Interview, 05.07.2015).

In Bhutan exist a system of granting parcels of land by the reigning King to citizens of the country. It is a prerogative right of the monarch, which is also laid down in the Bhutanese constitution and is called Kidu. Rehabilitation of land, as a form of Kidu, is more specifically granted to marginal farmers, whose land has been destroyed by natural calamities, farmers living in ecological-risk prone areas, and landless households (RGoB, 2007). According to an elderly farmer, Kidu was given to a majority of people who asked for it around 30–40 years back, whereas it has become more difficult nowadays and land is currently mostly given as rehabilitation land (F5, Personal Interview, 16.09.2015).

**Land categories**

Agricultural land is legally recorded on the Thram among three categories:

- Chhuzhing: Irrigated and/or bench terraced agricultural land for paddy based cropping systems.
- Cash crops land used for: I Apples, II Oranges, III Cardamom and IV any other cash crop.
- Kamzhing: Land other than Chhuzhing and orchard (e.g. Cardamom).

(RGoB, 2007)

**Division of land (inheritance)**

Different traditional inheritance systems are found in Bhutan that vary between regions. A matrilineal system can be found in the Western and Central part of the country, in which land ownership and property (e.g. livestock) is usually inherited from mother to the eldest daughter (The World Bank Group and NCWC, 2013). In the Southern part, including the project region, a traditional patrilineal system from father to son is still prevalent (E3, Personal Interview, 15.09.2015). The differences among inheritance systems in Bhutan are said to reflect local traditions and religions and are linked to the care of aging parents (The World Bank Group and NCWC, 2013). However, there seems to be a trend among the younger generation that tends to favour inheritance by all children, regardless of gender (ibid). This trend was also confirmed by a local expert in the project region who admitted that traditional inheritance systems are changing and that all siblings, sons and daughters alike, shall get equal shares of land nowadays but that it would depend on the decision of parents and cooperation of siblings (E3, Personal Interview, 15.09.2015). The care of aging parents was also a repeated issue during field work and one farmer highlighted in this direction that he will give equal share of land to all of his children, whereas the one who stays back at the farm to take care for the parents will get additional land (F4, Personal Interview, 19.09.2015).

**Conversion of land**

In order to secure food self-sufficiency, landowners in Bhutan are only allowed under special circumstances to change the land category of Chhuzhing into another category such as for other agricultural activities (Kamzhing, orchards) or residential areas. In case of a desired change of land category by farmers, representatives of the Ministry of Agriculture, following technical criteria including water availability, soil condition and environmental conditions, evaluate the feasibility of paddy cultivation on the particular land (RGoB, 2007). Additionally, Chhuzhing can be used for the construction of houses only in case that the whole land remaining falls under
land category of chhuzhing and gives the landowner no other possibility than to use this land for residential purposes (RGoB, 2007).

Fallow land / non-utilization of land
Owners of kidu or rehabilitation land are not allowed to sell their landholding for 10 years. The Land Act 2007 furthermore imposes the occupation and use of land. Non-utilization of registered land for a duration of 3 years can lead to cancelation of the respective land, which would become government property (RGoB, 2007). As an example a farmer in the village, who came as a resettler to the village, had to return to the village from his off-farm employment, after a written request from the government, to cultivate his registered land to avoid cancelling of the same (F2, Personal Interview, 11.09.2015).

Fallow land is a phenomenon frequently found in the project region, which is seen as a consequence of structural changes in the region that include migration movements and livelihoods diversification among other factors. A small number of aging household members are often not able to cultivate the whole farmland like in the past. Due to this shortage of labour, farm households would leave parts of their land fallow for a limited duration of time. However, owners of this land would hardly sell their land, as it has become an important asset nowadays. Even if the current generation might not need it, the land is taken as a reserve for following generations or other relatives who are in need of land (AS, Informal Interview, 05.07.2015).

4.4.4 Role of the forest

Bhutan follows an ambitious attempt according preservation of forest resources, with a legal decree to maintain a minimum area of 60 % tree cover for all time at a national level (NEC, 2008). The preservation and sustainable use of the environment is one of the key elements of the Bhutanese environmental policies. In this direction, the path of forest transition Bhutan is aiming for, was termed as motivated by an ecocentric development model by Lambin and Meyfroidt (2010), which is associated to central government policies and a forest ownership regime of mostly publicly owned forestland.

Forest with closed tree canopy is clearly the dominant land cover type in Bhutan, holding for 70.46 % of the total land cover excluding shrubs with a slight increase of total forest area from 25,558 km² in 1990 to 26,732 km² in 2010 (NEC, 2016). The forests in Bhutan are managed as Government Reserve Forests (GRF) and are protected by the Forest and Nature Conservation Act of 1995 (NEC, 2008). Private forestry is done in very limited extent in Bhutan. Only 138 hectares were managed privately in 2013 (RNR statistical coordination section, 2015). Establishment of community forests was brought forward in Bhutan with the Forest and Nature Conservation Act 1995, in which members of rural communities were empowered to manage and utilize state owned forest resources. Since 1996, 600 Community forests were established in Bhutan until 2014-2015, covering 66,934 hectares of forest with 25,663 members included (ibid).

The dominant forest type in Bhutan is given by broadleaf forest, with a share of 62.43 % of the total land area, while mixed conifer forest (22.69 %) and fir forest (6.77 %) are other important types (NEC, 2016). Broadleaf forests are located in the southern part of the country and fall under three broad vegetation zones. Tropical broadleaf forest zone, sub-tropical broadleaf forest zone and temperate broadleaf forest zone are found (Norbu, 2002). The significance of the forest for the land-use system is manifold. Broadleaf forests provide a variety of goods for people in Bhutan such as wood, fodder and non-wood products and are seen as a ‘food-bank' for people living in remote areas (ibid). This variety of services provided for the people make it an important source to sustain rural livelihoods. One important aspect, the fodder and grazing aspect, has gained repeated attention from scholars, studying impacts of forest grazing by cattle in different regions of Bhutan (Roder et al., 2003), (Wangchuk et al., 2014), (Roder et al., 2002). After the advent of modernization, forest management in Bhutan, executed by governmental institutions, laid a focus on wood production, whereas other non-timber issues, such
as cattle grazing in forests, which is an important social and economic activity for farmers, has been widely overlooked for a long time (Norbu, 2002). A large part of the broadleaf forests is said to be still intact, whereas the increasing number of cattle in the past has also contributed to degradation of forest resources. Cattle grazing is claimed to be present in all broadleaf forests without exact records of the respective impacts in different places (ibid). In order to conserve the broadleaf forests in the long run, the author suggests that forest grazing, which has severe implications on the ecological stability of the forests in certain regions could be either banned or, where livestock and forest grazing are the sole economic base, should be integrated into the forest management (ibid).

4.4.5 Land Types and farming practices

Farming practices in Bhutan strongly correlate with the agro-ecological zones ranging from wet subtropical regions to alpine areas where even semi-nomadic agro-pastoralists are found as shown in Figure 3. In each zone, different farming systems dependent on precipitation, altitude and air temperature (Dorji, 2008) are found.

<table>
<thead>
<tr>
<th>Agro-ecological zone</th>
<th>Altitude range (m. asl)</th>
<th>Annual rainfall (mm)</th>
<th>Air temperature (°C)</th>
<th>Farming systems, crop production and animal husbandry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine</td>
<td>3,600–4,100</td>
<td>&lt;650</td>
<td>12.0 to 1.9</td>
<td>Semi-nomadic people, yak herding, dairy products, barley, buckwheat, mustard, vegetables</td>
</tr>
<tr>
<td>Cool temperate</td>
<td>2,600–3,600</td>
<td>650–850</td>
<td>22.3 to 0.1</td>
<td>Yaks, cattle, sheep, horses, dairy products, barley, wheat, potatoes, buckwheat and mustard under shifting cultivation</td>
</tr>
<tr>
<td>Warm temperate</td>
<td>1,800–2,600</td>
<td>650–850</td>
<td>26.3 to 0.1</td>
<td>Rice on irrigated land, double cropped with wheat and mustard, barley and potatoes, temperate fruit trees, vegetables, cattle for draft and mutton,</td>
</tr>
<tr>
<td>Dry subtropical</td>
<td>1,200–1,800</td>
<td>850–1,200</td>
<td>28.7 to 3.1</td>
<td>Maize, rice, millet, pulses, fruit trees and vegetables, lemon grass, cattle, pigs, poultry</td>
</tr>
<tr>
<td>Humid subtropical</td>
<td>600–1,200</td>
<td>1,200–2,500</td>
<td>33.0 to 4.6</td>
<td>Irrigated rice rotated with mustard, wheat, pulses and vegetables, tropical fruit trees</td>
</tr>
<tr>
<td>Wet subtropical</td>
<td>150–600</td>
<td>2,500–5,500</td>
<td>34.6 to 11.6</td>
<td>Irrigated rice rotated with mustard, wheat, pulses and vegetables, tropical fruit trees</td>
</tr>
</tbody>
</table>

Figure 3: Agro-ecological zones and corresponding farming systems in Bhutan (Neuhoff et al., 2014)

The practice of shifting-cultivation, which is called Tseri in the national Dzongkhag language, was a main farming system in the east and central part of Bhutan. Nowadays it is forbidden due to unsustainable implications on the environment under nowadays conditions (NEC, 2008). Drawing on different land use types, Kamzhing, which means dryland cultivation, and Chhužhing, irrigated land for paddy cropping systems, are the main types of land-use practiced on cropland in Bhutan contributing for 60.6% and 28.4% respectively as shown in Table 7. Dryland cultivation occurs on terraced or non-terraced rain fed fields mostly set up on mountain slopes. Maize and potatoes are the main crops grown on Kamzhing. Mustard, turnips, buckwheat and vegetables are other annual crops that can be found in the temperate zones, while Millet is grown in the subtropical regions as a secondary crop (NEC, 2008). Wetland cultivation is irrigated, bench terraced paddy cultivation. Apart from rice, which is the primary crop, other crops such as wheat, potatoes and vegetables are cultivated as secondary crops in some places. In the milder, more-humid, subtropical areas, rice can be grown even twice a year. This land use type is mainly found in the fertile valleys of Paro, Wangdue and Punakha, while it is found scattered on hill slopes in other regions (UNDP, 2010).
### 4.4.6 Crop production

**Major crops**

Major cereal crops grown in Bhutan are wheat, barley, paddy, maize, buckwheat and millet (SYB, 2016) whereas maize and paddy play a dominant role for household consumption. Paddy is grown on 19,587 hectares with an average yield of 3,763 kg/ha, which corresponded to 75,229 t in 2013. Maize in comparison was cultivated on 24,027 hectares but with lower yields of 2,995 kg / ha corresponding to 74,372 t.

Table 8 shows the cultivation area of major cereal crops in Bhutan and Dagana and yields for major cereal crops in Dagana district. The cultivation area is dominated by maize, followed by paddy and buckwheat/millet, both country-wise and district-wise, whereas wheat and barley cultivation are found only to a minor extent in Dagana district.

<table>
<thead>
<tr>
<th>Cereal crop</th>
<th>Cultivated area Bhutan (hectare)</th>
<th>Cultivated area Dagana (hectare)</th>
<th>Yield (kg / hectare) in Dagana 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>24027</td>
<td>2599</td>
<td>2943</td>
</tr>
<tr>
<td>Paddy</td>
<td>19586</td>
<td>1480</td>
<td>3743</td>
</tr>
<tr>
<td>Buckwheat/millet</td>
<td>4716</td>
<td>497</td>
<td>1252</td>
</tr>
<tr>
<td>Wheat / Barley</td>
<td>3364</td>
<td>66</td>
<td>1385</td>
</tr>
<tr>
<td>Total</td>
<td>51,693</td>
<td>4,642</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 8: Cultivated area of major cereal crops (Bhutan and Dagana) and yields (Dagana) in 2013 (adapted from: SYB, 2016)

On a policy level, it has been an aim of the RGoB to increase the production of food commodities and raise the national self-sufficiency rate of cereals and essential oil crops during the 10th and 11th FYP (GNHC, 2013). A special focus was laid on the production of paddy in order to increase the self-sufficiency rate from 53 % to 65 % till 2020 of paddy consumed by the Bhutanese population (ibid).
Cash crops on the rise
The economic structure in Bhutan has changed since the advent of modernisation from a subsistence-based economy to a modern wage-based market economy. Nowadays, there is an increasing trend in the country for the cultivation of cash crops (SYB, 2016) which holds also true for farming practices in Dagana district. In 2013, mandarin production was most important on a district level (4154 t), followed by arecanut (671 t), chili (147 t), mustard (69 t), ginger (39 t) and large cardamom (26 t) (RNR statistical coordination section, 2015).

Looking at a national level in terms of money value that were exported in 2014, potatoes reached Nu.688.79 million (= 9,5665 million €), followed by mandarins Nu.542.56 million (= 7,54 million €) and large cardamom Nu.421.42 million (= 5,85 million €) (SYB, 2016). These cash-crops were identified as most important cash-crops in terms of growth potential for the agricultural sector in Bhutan (Christensen et al., 2012). Large cardamom has even reached the "Top Ten" commodities for export with a value of Nu.1.342 billion (= 18,644 million €) in 2016 (Department of Revenue and Customs, 2016).

4.4.7 Animal husbandry
"Livestock husbandry is one of the central components of agricultural farming and thus it remains as the main economy for subsistence farmers in the rural areas of the country" (RNR statistical coordination section, 2015: 42).

Throughout the different agro-ecological zones, products such as milk, eggs, honey but foremost draught power and farm manure are important products of the farming system. According to (Neuhoff et al., 2014) the livestock is only kept for subsistence or local market purpose and would fulfil any standard of certified organic agriculture due to a traditional way of keeping them in free flocks.

Table 9 shows livestock numbers in Dagana and Bhutan. Cattle and poultry, followed by yaks, goats and horses dominate animal husbandry in Bhutan in terms of numbers. In contrast, animal husbandry in Dagana is dominated by poultry, cattle and goats. Pigs play a less, yet important role in relation to total numbers. Sheep and horses only play a minor role on a district level.

<table>
<thead>
<tr>
<th></th>
<th>Poultry</th>
<th>Yaks</th>
<th>Horses</th>
<th>Pigs</th>
<th>Local Cattle</th>
<th>Improved cattle</th>
<th>Sheep</th>
<th>Goats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dagana</td>
<td>28133</td>
<td>0</td>
<td>379</td>
<td>1781</td>
<td>13574</td>
<td>3582</td>
<td>267</td>
<td>7182</td>
</tr>
<tr>
<td>Bhutan</td>
<td>638501</td>
<td>38222</td>
<td>20253</td>
<td>15727</td>
<td>211106</td>
<td>92380</td>
<td>11410</td>
<td>41983</td>
</tr>
</tbody>
</table>

Table 9: Livestock numbers (head) in Bhutan and Dagana 2015 (adapted from: SYB, 2016)
5 Findings

5.1 Inspecting the site

The following chapter provides an overview of the Buedulum Chhu watershed that was selected for a larger research project on forest ecology and sustainable use of natural resources, and the village of Tashithang, which is situated inside this area and serves as project site for the here presented Master thesis. The chapter contains data from literature, as well as from participant observation, semi-structured, and ethnographical interviews during the first stage of field work in the area.

5.1.1 Buedulum Chhu watershed in Dagana

Research for this study was conducted in the village of Tashithang that is situated in a critical watershed area called Buedulum Chhu watershed, one of the six critical watersheds identified in the country under Dagana district (see Figure 5). The Watershed Management Division (WMD), a National focal agency under the Department of Forests and Park Services, has conducted a rapid assessment and classification study of 52 watersheds in Bhutan from which 6 watersheds were selected as being ‘critical’. One of these critical watersheds is the Buedulum Chhu watershed in Dagana district. It is important to mention, that the demarcation of a watershed is based on biophysical facilities like a hydrological cycle, ecosystem service and further biophysical properties and is not based on political or administrative demarcation. This may lead to the fact, like in the case presented here, that different administrative units fall into one watershed area. Totally 9 chiwogs (villages) that fall under three different geogs (village blocks) are part of this watershed area as shown in Table 10.

The critical Buedulum Chhu watershed was selected for a research project on forest ecology and sustainable use of natural resources among the University of Life Sciences in Vienna (BOKU) and a Bhutanese research institution on natural resources (RNR-RDC Yusipang) with the overall goal of “enhancing livelihoods in Bhutan through improved adaptation measures to climate change and increased carbon stocks”. The project is in process since 2013 comprising 6 working packages.

Figure 5: Location of critical watershed sited in Dagana district; Source: (WMD, not publ.)
Critical issues in the watershed

According to the identified critical issues in the watershed, the WMD has developed a management plan "to address the various land use and water related problems within the Buedulum Chhu watershed by improving the natural resources and ecosystem services within the area and enhancing the livelihood of the local communities within its boundaries" (WMD, not publ.). Based on a participatory management planning process with key stakeholders from the project areas, different land-use related issues were identified (ibid):

- Landslides caused by unstable geological conditions and improper land use practices
- Loss of soil fertility on steep agricultural land by erosion, primarily caused by water
- Loss of crops to wild animals (monkey, wild boar & bear)
- Insufficient water for irrigation (decreased water availability at source)
- Leakage/seepage of water through irrigation channels
- Lack of proper water distribution facilities.

Perceptions from village representatives on land-use change

It is the aim of this chapter to present general patterns concerning land-use and rural livelihoods that became apparent during the first research phase collected mainly during interviews with village representatives and extension officers of different chiwogs. Due to the heterogeneity of the project area it cannot represent all individual particularities of villages or administrative units but shall rather serve as an overview.

(1) Demographical trends in the project area

Officially, app. 5200 people live in the watershed area with a nearly equal distribution among men and women (see Table 10). The settlements are mostly scattered along ridges and valley flanks and can be found on predominantly steep terrain with altitudes between 500–2475 m and slopes ranging from 0 %–189 % (Norbu, 2015).

<table>
<thead>
<tr>
<th>Geog</th>
<th>Chiwog</th>
<th>HH</th>
<th>Male</th>
<th>Female</th>
<th>Total pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karna</td>
<td>Khagochen</td>
<td>42</td>
<td>121</td>
<td>107</td>
<td>228</td>
</tr>
<tr>
<td></td>
<td>Pungsi</td>
<td>47</td>
<td>258</td>
<td>278</td>
<td>536</td>
</tr>
<tr>
<td>Gesarling</td>
<td>Tashithang</td>
<td>76</td>
<td>418</td>
<td>320</td>
<td>738</td>
</tr>
<tr>
<td></td>
<td>Phuensumgang</td>
<td>25</td>
<td>218</td>
<td>180</td>
<td>398</td>
</tr>
<tr>
<td>Goshi</td>
<td>Upper Goshi</td>
<td>62</td>
<td>286</td>
<td>271</td>
<td>557</td>
</tr>
<tr>
<td></td>
<td>Middle Goshi</td>
<td>71</td>
<td>315</td>
<td>278</td>
<td>593</td>
</tr>
<tr>
<td></td>
<td>Lower Goshi</td>
<td>71</td>
<td>307</td>
<td>325</td>
<td>632</td>
</tr>
<tr>
<td></td>
<td>Balaygang</td>
<td>90</td>
<td>376</td>
<td>390</td>
<td>766</td>
</tr>
<tr>
<td></td>
<td>Dogak</td>
<td>81</td>
<td>378</td>
<td>377</td>
<td>755</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>565</td>
<td>2677</td>
<td>2526</td>
<td>5203</td>
</tr>
</tbody>
</table>

Table 10: Population in project region according to census data (adapted from WMD report 2015)

However, the number from the census data does not match with the actual number of permanent settlers in the villages, which was said by representatives to be much lower. According to population dynamics in the project area, there is a pattern of exceptionally low number of permanent settlers per household in relation to the household members according to census data in all the villages, except of one village (Phuensumgang). Apart from small children below school age, usually only father, mother and, if still alive, the grandparents live in the households, while the rest stays outside of the village. According to an RNR extension officer, only the old and poor stay back in the village due to lack of opportunities, whereas young people go for an easy life (rep Kana geog), Personal Interview, 06.07.2015. This situation leads to a discrepancy between census data that counts people as residents, and the actual population that live permanently in the villages. The children are in school or...
higher education/training inside or outside the watershed area, from where they usually come back home only during their winter vacation for two months. Other household members are employed in government service, contract work and other kinds of wage labour outside of the village. This situation is related to a prevalent shortage of labour force for agricultural activities and is associated with an increase in labour costs within the region according to local authorities.

Resettlers are immigrants that have settled in the project region since the mid 1990s from different parts of the country where they have faced difficult conditions to continue their farm work. His Majesty the King granted them kidu or rehabilitation land for free to make a living from it. The distribution of resettler households in the project region varies among the villages. Village representatives in the watershed agree, that a peaceful cohabitation and a reciprocal adaptation process has happened in the villages, among which resettlers have already adapted certain farming practices of the local inhabitants.

(2) Livelihoods
Livelihoods and the standard of living for people in the project region have generally improved due to the development process and new economic opportunities according to extension officers and village representatives. There is a trend of a vanishing subsistence-oriented way of life with a high share of self-sufficiency, towards a focus on cash crops and a general diversification of livelihoods. However, agricultural production is still seen as the dominant way of sustaining livelihoods of permanent settlers in the project region. Mandarin (Citrus reticulata) and large cardamom (Amomum subulatum), cultivated for external markets, are actually the most important cash crops to sustain farmers’ livelihoods. Hazelnut, a cash crop introduced by an international company in Bhutan, is a new crop in the region and is an aspirant to become important in the future. Vegetables, dairy products and meat are sold locally, mostly in small quantities. This is done either in the village itself, at local Sunday markets in larger towns, or in local institutions such as Lakhangs (monasteries) or schools. Paddy and maize are the main food crops still grown to cover subsistence needs, whereas smaller quantities of buckwheat, millet, wheat, barley and potatoes are grown mainly for household consumption. Cereals, especially maize, barley and millet are also cultivated to produce locally brewed alcohol. Table 11 shows the extension of major agricultural crops grown in the project area.

<table>
<thead>
<tr>
<th>Cereal crop (hectare)</th>
<th>Paddy</th>
<th>Maize</th>
<th>Wheat</th>
<th>Barley</th>
<th>Buckwheat</th>
<th>Millet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gesarling</td>
<td>119</td>
<td>91.9</td>
<td>0.8</td>
<td>1.5</td>
<td>11.9</td>
<td>21.3</td>
</tr>
<tr>
<td>Goshi</td>
<td>163.2</td>
<td>226</td>
<td>11.8</td>
<td>0.0</td>
<td>15.4</td>
<td>32.9</td>
</tr>
<tr>
<td>Kana</td>
<td>21.7</td>
<td>231.1</td>
<td>0.0</td>
<td>0.0</td>
<td>10.8</td>
<td>18.4</td>
</tr>
</tbody>
</table>

Table 11: Major agricultural crops in the geogs (WMD, not publ.)

However, local production of cereals is not sufficient to cover local demands and a substantial share of food consumed in farm households, especially rice, is bought from the market. Important off-farm employments in the region comprise contract working on farms during the season of labour demand peaks, working in the construction sector, running of small businesses such as small shops, or government service (e.g. schools, geog centres etc.). This change in land-use practices holds also true for Tashithang and can be seen as a general trend in the project area referring to (Norbu, 2015). According to the author, cardamom orchards were marked by participants as a "very important" land use type in all the 9 villages except of Balayang where it was marked as "important". Mandarin orchards are also seen as important, while paddy on irrigated wetland and maize on dry land were identified as the most important cereal crops on the respective land use types.
(3) Land-Use Issues
The dominant land use type in the watershed is forest (76%) of which the majority falls under government reserve forests (GRF). Besides that, two community forests are already established and 4 new forests under community control are in a process of approval. The role of the forest seems to have changed for farmers due to different reasons. Electrification of households and a subsequent decline of fuel wood utilization as well as a decline of a former transhumance system, linked to forest grazing, were mentioned as reasons for this change.

Farmland accounts for 18% of the land area and depends on the specific agro-climatic conditions that vary in the region, with dry land (Kamzhing), irrigated land for paddy cultivation (Chhuzhing) and orchards as the main land use types (Norbu, 2015). Figure 6 shows patterns of land-use mainly dominated by dry land for maize production and irrigated land for paddy cultivation without explication of cardamom orchards that have more recently gained much attention from land managers.
Mandarin and cardamom are predominantly grown as cash crops. The latter is spreading rapidly in the recent years and is planted even on paddy fields and kitchen gardens. Retired farmland left in fallow is a result of lack of workforce and new economic opportunities outside of the villages. The steep terrain in most parts hampers the mechanization of farming in most cases according to representatives. The majority of farmers prepare their fields following traditional practices, using ploughs drawn by bullocks, while a marginal number of power tillers were recently introduced on geog level to test the feasibility under local conditions. Human-wildlife conflict is one of the most important land-use issues identified throughout the watershed. Damage of agricultural crops primarily by Assamese Macaques is the single most important problem, closely followed by damages inflicted by wild boar and Himalayan Black Bear (Norbu, 2015).
Culture and tradition still play an important role for livestock rearing and meat production in Bhutan which became clear in a public debate about the establishment of a meat processing unit, planned by the government in 2015 (Kinga, 2015). Livestock rearing in the watershed area and in the Southern part as such has, unlike other parts of the country, a relatively stronger focus on the production of meat (E3, Informal Interview, 30.07.2015). Even though a range of ethnical and religious beliefs is present in the region, Lhotsampas tend to show a higher commitment to rear animals also for meat purposes due to cultural and religious beliefs than other parts of the Bhutanese society where people follow foremost the Buddhist religion that does not allow the killing of animals. This preference among southern Bhutanese has been taken up by the government that has set a focus for the development of the livestock sector in the South towards animal husbandry to cover larger parts of the national demand for meat (ibid) (see 4.3.1).

Cattle and large ruminants have been important in the past and are still used in small extent for a transhumance system of livestock rearing that uses the forest as main fodder source to produce dairy products. The importance of this system has decreased nowadays due to changing economic opportunities and a lack of workforce. However, cattle still play a major role for the local livestock system and provide dairy products, manure and draft power for the farm households, apart from their religious value for a major group of people following the Hindu religion. Local-, and improved Jersey-, and Mithun-breeds are found in the region whereas cattle numbers vary strongly among village blocks as shown in Table 12.

<table>
<thead>
<tr>
<th>Geog</th>
<th>Cattle [head]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gesarling</td>
<td>983</td>
</tr>
<tr>
<td>Goshi</td>
<td>456</td>
</tr>
<tr>
<td>Kana</td>
<td>2474</td>
</tr>
<tr>
<td>Total</td>
<td>3913</td>
</tr>
</tbody>
</table>

Table 12: Number of cattle (head) in the project region (Source: WMD, not publ.)

From a local perspective, the livestock system seems to be in a transition. Poultry, goats and pigs and to a lesser extent sheep and fish also play a role in the watershed area, with differences in consumption patterns and associated habits of animal rearing due to ethnic and religious heterogeneity. However, cattle farming, as major part of the livestock system, is shifting towards a stall-feeding cut & carry system (see appendix 11.4), building on improved jersey cattle and on-farm fodder plants to intensify milk production for income purposes and facilitate dairy production in times of labour shortage.

(4) Drivers of change
Drivers of change got strongly associated with far-reaching development and modernization activities in the region that started in the 1980s with the construction of basic infrastructure. However, the 9 villages belong to three different administrative units and the development process has happened in varying speed and extent. A highway connects Kana geog, one of the three administrative units, with the higher-level road network since 1983. This is assumed to be a major step of development, which decreased transportation costs for the concerned villages opening new economic opportunities. The highway to Dagana Dzong traverses the middle of the watershed over a length of 25.5 km and a newly constructed road to Dorona geog crosses the eastern part of the watershed. A relatively dense network of farm roads with a total length of 42.6 km has been constructed as of 2014 in the watershed, providing access to all chiwogs, which again increased the general accessibility within and also between chiwogs (WMD, not publ.). The road access was additionally associated with an increasing availability of goods in the region. Schools have been named by village representatives as additional infrastructure activities that contributed as a driver of change and modernization. More recently, small schools get increasingly closed due to a shift in the national education system towards a more centralized education system in order to bundle available resources (see 5.3). Another important driver was claimed to be the hospital of Dagapela close to the project region, and additional basic health-units in some of the villages, which together
ensure the medical supply in the region. Family planning was promoted via these medical facilities and was mentioned as a reason for the subsequent decrease in household members due to advocacy and promotion of contraceptive methods that suggest a maximum of three children per family according to a village representative (rep (Kana geog), Personal interview, 05.07.2015). Rural water supply scheme provided tap water for villagers and were seen as another development step accomplished mainly in the last decade. Most recently, villages were connected to the national electricity grid. This happened between 2003/2004 and 2012 and was claimed as one of the most important steps in the modernization process that made people’s life more convenient and was even noted as ‘paradisiac’ by interview partners. The upcoming of new communication and information facilities such as mobile phones and television sets are related to the availability of electricity and the concurrent installation of a telecommunication tower in 2008.

Apart from that, development efforts have also affected farming practices directly in providing new technologies for farmers to modernize farming and increase the local production. Improved varieties of vegetables, maize, paddy and mustard have arrived in the region and are subsidized from the government. Furthermore, improved animal breeds of cattle, goats, pigs, poultry and sheep are available and increasingly replace local breeds. Chemical fertilizer and certain classes of pesticides are available in regional RNR offices but must be purchased at full price by farmers whereas ≈15 years back pesticides were fully subsidized from the government (E2, Personal Interview, 15.09.2015). Recently the installation of fences, such as barbed wire fencing or electric-fencing becomes popular among farmers in some villages to protect their field crops from wild animals. Biogas facilities were introduced to provide cooking gas for farm households with bio-slurry as a by-product by using (cow) dung, and energy-efficient clay stoves have been established only most recently in 2015 in the villages of the region to raise the energy efficiency and reduce formation of smoke inside the households, associated to health risks, at the same time.

These drivers that were mentioned by representatives are generally more linked to physical or technological arrangements that were brought to the region. Apart from that, additional drivers were claimed to affect the local land use system that seem to be more process-related. Rural-out migration and associated labour shortage were named as important driver in this direction by several representatives. Resettlement of people from different parts of the country from 1995 onwards, and a subsequent process of adaptation and cohabitation has been claimed as another important process related to land-use change.

5.1.2 Tashithang chiwog

Tashithang village was selected as research area for this study and serves as a case study in the here presented context (see Figure 7). The primary study site and starting point for fieldwork was the farm household of the village head in Tashithang. For a detailed ethnographical description of the farm household including issues related to land-use change see (Annex 11.5). Based on data from personal observations and a semi-structured interview with the local village head I want to introduce some general aspects of the village and its peculiarities according to the subject of interest.

Tashithang is one of the largest villages in the project area (by population). 600 inhabitants live, according to census data, in 72 households of which 17 resettler households from other parts of the country comprise for ≈24 % and contribute to a diversification of ethnicities and religious beliefs (F10, Informal Interview, 07.09.2015). However, only 65 % of the official population live permanently in the village according to F10 while the rest stays outside for most of the year in education/training or is employed in government service or other types of wage labour. Inhabitants of Tashithang focus on the production of agricultural crops. Cardamom is currently the most important crop in terms of cash income and new plantations have restarted only recently in 2012/2013 after a severe cross-national disease has wiped out large parts of former orchards. Apart from that, farmers in lower parts of the village also maintain mandarin orchards due to the good climatic suitability for this crop. Besides these cash crops for external markets that are often traded by intermediaries who come to the village,
vegetables and fruits are produced mostly for local markets inside the village, for local institutions (schools and monasteries,) and for the Sunday market in the nearby Dagapela town area. Dairy products, such as butter and cheese, are seen as another pillar for local sales by F10. According to the village head (F10) 90% of the farm households can sustain from farming only, whereas 10% of the farm households need to get extra income from off-farm employment to sustain their living. With respect to self-sufficiency in the village, he said that the farmers only produce around 40% of their food, whereas 60% needs to be purchased. A small shop in the village itself provides basic commodities such as processed food items, everyday commodities from industrial production and a small bar serving alcoholic drinks, whereas rice can be purchased in particular grocery shops in the nearby Dagapela region and at a settling of the FCB (Food Corporation of Bhutan) near Dagapela. Tashithang is also facing a problem of labour shortage that manifests in high labour costs and associated land use issues (F10, Personal Interview, 12.07.2015).
The effects of an internal political conflict in Bhutan, that also raised international attention (Zurick, 2006) in the beginning of the 1990s, has affected the village of Tashithang in a profound way. Almost 100,000 ethnic Nepalis were evicted after episodes of demonstrations and civil unrest against the ruling government when they could not attest historical residence in Bhutan in the form of legal documents (Zurick, 2006). According to interview partners, this conflict was pivotal for a tremendous decline in household and population numbers from 80-90 households before 1990 to only 25 households remaining after the conflict in the early 1990s mainly due to out-migration. The number of households has increased since then due to establishment of new households by
descendants and additional resettlement of Bhutanese citizens from other parts of the country. It is not a focus of this work to look particularly at implications of this conflict on changes of the land-use system and rural livelihoods. However, it appears that this conflict and interrelated out-migration have had far-reaching and long lasting implications for changes in the local system. The land, being inhabited and cultivated by small holders over decades, got suddenly abandoned. Such kind of shock might have effects on the social cohesion as much as on cultivation patterns and land use practices due to a strong decrease of population numbers. For further information about the political conflict at the beginning 1990s see (Hutt, 1996).

5.2 Agrarian change: From food to cash

Cash crops play an important role in the critical watershed and certainly in the village of Tashithang. The increased focus on few, highly profitable, crops is comparably new in the village and raises questions on economic vulnerability, environmental pressures and food sustainability. An elderly farmer (F1) in the village sheds light on this shift and highlights the current importance of profitable cash-crops for farmers as it gives them a high economic return and saves additionally labour-time, which has become increasingly rare in the households:

"Let me say: If I plant Maize, who will take care for it? Where are the ox and the person who goes for ploughing? We have to do everything, isn’t it? […] Even it gives a low income to us. […] And then, if we plant cardamom - comparing the price nowadays it gives a high profit. There is also little work that has to be done. And then, if there is so much work, how is a couple able to do? Right?"

(F1, Personal Interview, 14.09.2015).

In this chapter it is the aim to outline aspects of a still on-going process of agrarian change in which commercialization of agriculture plays an essential role. The village of Tashithang appears to be in a transition. From a mainly subsistence-oriented agrarian community the trend goes to diversified livelihoods strategies with the aim to gain cash-income via agricultural activities or off-farm employment. In this sense, I will first (5.2.1) present major development conditions with a focus on infrastructure development, that seem to have framed the setting of an agrarian transition in the critical watershed according to interview partners. In (5.2.2) I explicate changes in the local farming system that appear to show a dwindling role of cereal crops, an intensification of the livestock system and a trend towards the cultivation of cash crops. After that, I will highlight two crops that seem to be of special interest for current and future trajectories of land use in the region. Large cardamom (5.2.3) is a very profitable crop that was already grown in the village from 1965 onwards by a small group of farmers and has become very popular in recent years, replacing food crops for household consumption in fast-pace. Hazelnut (5.2.4) was introduced in Tashithang in 2015 by an international company and provides technical assistance, secured international markets and a calculable price for farmers, which might put additional pressure on low-value staple crops and might change land-use practices accordingly.

5.2.1 Development for agrarian change: Infrastructure and the road of modernization

"There is one saying that when we die, we go to heaven but he is assuming already a little heaven has come to the village. It started with schooling. The school came to village, then the road, the electricity, and then the road inside the villages came” (F8, Personal Interview, 1.10.2015, translated).

The process of development and modernization started late in the village of Tashithang. The connection of (farm) roads, together with the supply of electricity for the village have been mentioned as most important development activities in the village by the local village head.
Roads and Highways

Bhutan’s road transportation network is classified into 5 types of roads:
(1) National highways, (2) Feeder Roads, (3) Farm roads, (4) Thromde roads (in urban areas) and (5) Access roads. A national north-south highway reached the region in 1983/84 in Kana geog and gave access to a higher-level road network (rep [Kana geog], Personal Interview, 06.07.2015). Later, in 1989 an unpaved connection road from Dagapela, the nearest town, up to the village of Tashithang was built and provided access to this road network whereas the construction of farm roads, to increase the motorized accessibility of villages and farm households even more, was started around the year 2000 (F10, Informal Interview, 07.09.2015). These have been the most important development activities for the village, according to the village head. It took another few more years until the first vehicles came up in the village in the year 2002/2003 and the number has increased rapidly since then (E3, Informal Interview, 17.09.2015). The availability of vehicles and road access opened up new opportunities for the people. Before the introduction of roads in the area, farmers, like F8, had to take a 2–3 days horse-ride to reach Kalichola, the nearest village at the Indian border in this time, to sell their produce. This exit point has nowadays lost its importance and farmers either sell their produce for external markets to merchants that come to the village or can bring it directly to the towns of Phuentsholing or Gelephu (150 km), which have become important trading points also for farm products (F8, Personal Interview, 01.10.2015).

Another example for far-reaching effects of transport infrastructure is the change in food consumption patterns. Before 1998, villagers used to eat mainly maize. From there on, salesmen of rice became more frequent in the region and people started to buy rice, which they first had to carry troublesome to their homes, until the first vehicles in Dagapela and later in Tashithang (2002/2003) made the cereal much more easily accessible to the residents of the village. Nowadays, only 10–15 % of the households still consume maize as a staple food (F10, Informal Interview, 16.09.2015). Sales people of rice have become even more frequent and the number of vehicles is currently increasing rapidly in the village. This trend is also boosted by competition among villagers for the possession of motorized vehicles (E3, Informal Interview, 17.09.2015).

Figure 8: Construction of the new Dagapela-Dalbari highway passing Tashithang (own picture: 02.08.2015)

Tashithang is one of the villages that will get connected to a larger road network that joins the southern region in Dagana with a border city to India in the near future (see Figure 8). According to an actual newspaper article, the construction of the highway was resumed by the end of January 2017 after it was terminated in March 2015 due to accuses of corruption from the contractor’s side (Dema, 2017). Currently, farmers that export goods to India, have to bring them to Gelephu, which is the nearest border city, about 150 km away from the village. The

An elderly farmer (F7) claims that roads are of uttermost help for him and his wife. It has become easier for them to bring rice from the market even to their house by the help of vehicles, which was a troublesome task in the past. Moreover, the road benefits them to sell their cardamom as cars can take the produce from the harvest plot to the selling point without additional transportation costs for workers. Additionally, they benefit from roads in case of a health emergency (F7, Personal Interview, 13.09.2015).
new highway will work as a short cut for the import and export of goods and will accordingly increase the economic activities in the region. This future development would improve the livelihoods of the farmers as an official in the education sector argues. As an example, he mentions the marketing of cardamom that could be done by the farmers themselves in future instead of selling their produce to middlemen, losing the profit margin (TK, Informal Interview, 20.07.2015). The aforementioned newspaper article quotes: "The secondary national highway is expected to enhance economic efficiency and competitiveness of the export industry by providing faster and more reliable freight movement" (Dema, 2017).

**Electricity**

Tashithang was connected to the national electricity network only in the year 2012. Before that, people were dependent on biomass as main energy source, mainly fuel wood, for preparation of daily food and fodder for animals. Collecting firewood was said to be a straining and time-consuming task for the household-members. For that reason, the predominant way of cooking has already shifted to new technologies that have entered the household in terms of an electric pan and an electric rice-cooker (see Figure 9). These devices released household members to a large extent from the task of collecting fuel wood and have two other side effects.

On the one hand it contributes to decreasing health risks from smoke during the cooking process over open fire. On the other hand, it may reduce the pressure on forest resources. Preparation of fodder in contrary is still done over open fire, which was mentioned as important contributor in terms of biomass use in the agricultural sector nation-wide (NEC, 2012). Referring to personal observations, there is a constant risk of power blackouts in the region during the monsoon season of heavy rainfalls. For this case, people still maintain traditional facilities in their homes, foremost the traditional clay-made stove, still used for cooking on a regular basis. An electric mill for rice and maize is another important device that got installed in one farm household and may alleviate the work of manual grinding of cereals that is still done inside the households by using a small hand-driven stone-mill. Electricity has furthermore changed communication patterns in the village. Mobile phones that have entered into the daily lives of residents in Tashithang require electricity for the frequent recharging of batteries.

![Figure 9: Electrical tools side by side with traditional stove (own picture: 11.09.2015)](image)

A television set, with numerous national, Indian and international channels, was installed only 4 months before my arrival in the house of the local village head in 2015. It is also important to mention that rural households get, to a certain extent, free energy units, provided from the RGoB. In the household of F10, for example, the limit of these units has never been exceeded.
Infrastructure development in the region has far-reaching implications for land use and livelihoods in Tashithang village and the project region. On the one hand, this development already offers new economic opportunities for farmers to sell (high-value) products, due to the better accessibility of markets and reduces transportation costs. This seems to provide a strong incentive for the farmers to change traditional cultivation practices and follow market demands. This drives changes in farming practices with unpredictable effects on sustainable land-use practices and livelihoods. The construction of the highway to India via Tashithang may further boost this development in the near future. The availability and accessibility of cheap imported food from India, on the other hand, seems to put additional pressure on the local agriculture. Cheap and easily available rice makes it easier for farmers to satisfy their daily needs for food and to reduce the area of cereal crops (mainly maize) planted for subsistence needs in favour of cash crops. Electricity has only recently arrived in the village of Tashithang. Availability of cheap and clean energy seems to change daily practices and use of natural resources. Processing and preparation of food is affected directly by the use of electric devices, whereas communication patterns change due to an increasing use of mobile phones and accessibility to worldwide information via television. The reduced demand for fuel wood also impacts land use and may relieve pressure on woodlands.

5.2.2 Changes in the farming system

The farming system in the region and concurrently the livelihoods-strategies of farmers seem to be in a transition. The cultivation of land by planting food (e.g. cereal crops, vegetables) and oil crops (mustard) in addition with livestock rearing to meet subsistence needs is shifting towards the production of cash crops dependent on (external) markets, whereas farmers increasingly intensify their livestock system for dairy production towards permanent stable-feeding systems for milk production in combination with the use of improved jersey breeds. Dairy products serve both, for household consumption and for marketing purposes. 17 households in Tashithang have started to establish dairy farming to generate a part of their cash-income, whereas a group of farmers have proposed to operate a joint dairy cooperation on a commercial basis in Tashithang village (E2, Personal Interview, 12.07.2015). The government subsidized the construction of stables necessary for this new system financially (ibid).

Change in cultivation patterns

"The rice is already eaten up, but the work for it is still there" (VD, Nepalese saying)

This saying indicates the high amount of labour that has to be invested by farmers in paddy cultivation. A young farmer of a neighbouring village claims that an increasing number of farmers would nowadays refuse the work of paddy cultivation due to this fact (VD, Informal Interview, 08.08.2015). The diversity of food crops on the fields of farmers in Tashithang has generally declined. Reciprocally the dietary habits of the households have also changed (Personal observations).

Figure 10: Paddy plantations in Tashithang seem to decrease (own picture: 24.07.2015)
Nowadays, the majority of people, depending on the altitude and biophysical characteristics of their fields, mainly grow paddy (see Figure 10) and maize as their two major cereal crops. Only few households continue to grow additional cereals. Buckwheat is grown in 4–5 households to make a type of bread, while millet is only grown in one household to produce a locally brewed alcohol. Rice has replaced maize as the main staple food and is consumed three times a day in many households (F10, Informal Interview, 16.09.2015). This cannot be covered by local production alone but is additionally met by imported Rice from India that can be purchased from grocery shops in the Dagapela region or at the depot office of the FCB (Food Corporation of Bhutan Ltd.). However, this seems to be a recent phenomenon according to the village head: Before the year 1998, everybody in the village ate mainly locally cultivated maize. People would still like the taste of maize and F10 also highlights its nutritional value for the health. On the other hand, he argues that the cultivation and preparation of this crop needs some effort. The maize needs to be released from the corncob and has to be grinded either by hand or taken to an electric mill in the village. But even with this technology, he argues, people would rather prefer the 'easy way' of buying, washing and cooking rice from the market than to bring the maize down to the mill and take the grinded produce back home. 'It is easy' he said, laughing doubtful (F10, Informal Interview, 16.09.2015).

The local village head assumed that 40 % of the food consumed by farmers in the village is produced locally on their farms, whereas 60 % has to be purchased to fulfil the daily needs (F10, Personal Interview, 12.07.2015, translated). Farm households in the village are, generally speaking, neither able to cover the household demand of cereal crops, nor to provide a surplus of cereals to the local and national food market, which raises questions of local and national food sustainability.

A government employee gave his perception on the issue and argued that the national food self-sufficiency in Bhutan is very questionable from his perspective.

"Today whatever rice we eat we always depend on the Indian rice. We Bhutanese have very limited rice. The produce of Bhutan will not even last 1-2 months also" (Sonam E., Personal Interview, 19.09.2015)

He refers to the agricultural statistics that assume a current rice self-sufficiency rate of 53 % with a ministry’s target to reach 65 % by 2020 and claims that "60 % is just that figure. In actual number it will come hardly 20 %". According to him, the numbers, which are presented on higher political levels, would not represent the reality. "So whatever data they will get in ministry level no? So whatever the minister will present on the national assembly or whatever maybe - is all bullshit data" (Sonam E., Personal Interview, 19.09.2015).

"[...] You just imagine the produce, the agriculture produce of Bhutan. If the Bhutanese would produce 65 % rice, the next 35 % is easily achievable. Very easily. But in real - there is no rice" (Sonam E., Personal Interview, 19.09.2015).

The decline of cereal crops in cultivation pattern goes along with an increase in cash crops:

"Cash-Crop is more now, because you have to rear the child, no? We have to study. We have to put our child at school. Student have to get the money, no? Cash crop is for that. For studying and ourselves also. [...] Because only food crops cannot grow us. By cash-crop we have to buy rice, sugar, milk, everything. If we have no cow, I have to buy milk powder. And sugar – our Bhutan there is no sugar. And tealeaf. We have to buy it, that’s why we need cash crops" (F2, Personal Interview, 11.09.2015).
Cash crops are inherently linked to monetary income and market participation. In order to meet their basic needs, farmers increasingly depend on the income of cash money as major resource. Besides that, costs for additional needs of a changing lifestyle seem to boost the need to gain an even higher amount of money. Costs for the education of children that are foremost significant in the private school sector may be one of the possible needs that get increasing attention in the households (see chapter 5.3). Apart from that, money is needed to purchase and maintain agricultural infrastructure, such as pesticides, sprinklers for irrigation, motorized grasscutter, rice-, or maize mills. Capital is further needed for investments in motorized vehicles and different types of consumer goods and household devices that gain increasing importance in the village.

Figure 11: Biswa karma puja: Villagers decorate their vehicles for a local Festival (own picture: 17.09.2015)

Needs for communication and information devices such as mobile phones and television-sets have come up and demand for further investments. For all these examples, farmers in the village need to earn money from the production of agricultural products and or additional off-farm employments. Cash crops play an essential role in this context and a local extension officer (E3) underlines the importance of revenues from cardamom cultivation for the farmers to enable them to afford high investment costs such as for the purchase of vehicles (E3, Informal Interview, 17.09.2015).

Large cardamom is currently seen as the most important cash crop in the village. Besides that, mandarin orchards (*Citrus reticulata*) in the lower parts of the village still contribute to the income of farmers in this part. According to an expert of the RNR-RDC Yusipang in the agricultural field, citrus yields are currently declining in all regions due to pests and diseases (especially *Citrus greening*), which reduces the options for cash-income in regions such as Tashithang. Cardamom would be a good option for farmers from his perspective, especially because of the high price at present (E6, Personal Interview, 14.08.2015). Besides of these two major cash crops, new cash crops are currently discussed and tested among farmers. The mountain hazelnuts venture was introduced in 2015 and presents the first project in Bhutan that is carried out totally by foreign direct investments. The project follows a contract farming system and involved 7 farmers in Tashithang that have fields at 1600 MASL or higher (F5, Informal Interview, 10.09.2015). Kiwi was said to be another candidate of cash crops for the farmers and is currently grown by 2 farmers. And last but not least, the recent order of 550 apple seedlings by farmers at the national seed bank in Paro reveals the potential importance of apple fruits in the near future for the farmers’ livelihoods in the village. The costs for this order must be carried 100 % by the farmers contrary to seeds for cereal crops, which are subsidized by the government by 50 % (F10, Informal Interview, 15.09.2015).
Summary: Changes in crop production

Livelihoods-strategies of farmers in Tashithang depend largely on the production of agricultural crops. However, the cultivation pattern in the village seems to change. A shift from a diverse, subsistence-oriented, cultivation practice towards a focus on cash crops, such as cardamom and mandarin orchards, ensures high economic revenues for farmers. Maize on Kamzhiing, and paddy on Chhużyting are still the two major cereal crops grown by farmers for their household consumption. However, the contribution of local agriculture to meet subsistence needs declines with increasing cash crop production. Currently about 40% of the staple crops consumed by households is produced locally, 60% are covered mainly by rice imported from India. In that way farmers in the village are dependent on imported food to meet their household demands and are hardly able to provide surplus for a local and national market. This development coincides also with increasing amount of imported rice from India since the 1980s and raises concerns about local and national food self-sufficiency that shall be increased by 2020, pointing on national policy strategies. Cardamom is currently the most prominent cash crop achieving high sales-prices in the village. Mandarin orchards have been another important cash crop, but seem to be threatened by a severe disease, whereas a variety of new cash crops are on the rise to extend economic options for farmers. Hazelnut is one cash crop that was recently introduced in the region and offers farmers a calculable price and a secure market. Apart from that, kiwi and apple are further aspirants that are presently discussed and tested among farmers.

Livestock system in transition

"While we are talking about the topic of jungle and cowboys, he is frying the buffalo-skin in the electric pan, saying that he likes this kind of life in the jungle. When he was 15 until he became 32 years he used to go up. He said that there was no tension. They only have to cut grass once a day and to do milking, but apart from that, they are free to do whatever they like" (F10, Informal Interview, 03.10.2015).

Besides changes in cultivation patterns, also the livestock system is in a transitory state. Different species of livestock, including cattle, goats, pigs, fish and poultry are kept in the village and contribute to food security and cash income. Large ruminants such as cattle have been especially important for the local land use system in terms of manure, labour and dairy products. The number of cattle has decreased strongly in the village. F5, an educated, elderly farmer in the village remembers his times as a school kid and highlights high numbers of 15, 20 or even 30 cattle per household in the past that went along with a higher number of people working in this sector (F5, Personal Interview, 16.09.2015).

Until the 1990s a form of transhumance of large ruminants like cattle, buffaloes (Bubalis bubalis) and mithuns (Bos frontalis), was still practiced in 7-8 households as the main livelihoods strategy, by breeding of animals and production of dairy products for the local market. Many of these farm families left the country during the time of political conflict and only 2-3 farm households remained after the conflict, continuing a transhumance system of livestock rearing (F10, Informal interview, 03.10.2015). During the summer season when the fields were cultivated with crops, farmers used to take their herds to provisional cowsheds in the nearby forests. One to two individuals always remained in the forest with a large part of the herd. Only few milking cows and oxen that were needed for ploughing stayed back at the farm (F8, Personal Interview, 01.10.2015, translated). F4, an elderly farmer, who recently started again to work as a 'cowboy' and takes his cattle again to the forest for a constant duration of few months at a stretch to produce dairy products, convincingly outlines the importance of the cattle in the past, when cowboys were still quite frequent in the region:

“They were all in the jungle. [...] Ok, mostly it would be in the jungle, like you know 100–150 is very high number it is not able to keep in our farm also, right? So they mostly will always [sic!] in the jungle, by changing their locations, one to the other. So all the time if we keep our cattle in one place only there will be no more grasses, so we have to change the location. By changing the locations mostly they have to be in the jungle, so fewer, only the fewer milking cows and ploughing ox only in the farm. Stay in the house or in the farm. All the rest only in the cow sheds” (F4, Personal Interview, 05.10.2015, translated).
This livelihoods strategy of transhumance has in large part disappeared and only one farm household has started again to follow this livelihoods strategy for supplementary household income. The extended forest that surrounds the village of Tashithang was a major resource base for this livestock system and seems to lose its importance in this direction. The environmental impacts of forest grazing are reduced by the decrease of this farming practice. Interview partners repeatedly mentioned the high number of labour force that was available to look after the animals. In that way, farmers were able to keep a large number of, even different, animals. F10 mentions two main reasons for abandoning the practice that his family followed until 2011 on their farm. First, the water source in the forest was starting to dry up. Cattle, but more than that Buffaloes, would have required more water. Secondly, the shortage of labour became prevalent in their household. There were no more people to do the work both, in the forest and on the farm simultaneously (F10, Informal Interview, 03.10.2015).

Although the role of the forest for the local farming system seems to have changed, it can still be used as a (fodder) source as farmers have a traditional right to graze their cattle in the forest as claimed by E4. The local community forest, where forest grazing is not allowed during the first 5 years after plantation of seedlings, is not seen as a major reason for declining use of forest resources for livestock rearing. Instead this transition is mainly an implication of the general labour shortage in the region. This is a major reason why animals are nowadays usually kept on the farms in much smaller quantities\textsuperscript{17} (E4, Informal Interview, 10.09.2015).

"Labour shortage, everywhere labour shortage. Son, daughter will look after job so there are only the old ones, no? So they are [sic!] keep good breed, less number, good breed, high yield"
(AEO; LEO, Personal Interview, 15.09.2015).

As E3, a government employee in charge for livestock mentions in this quote, it is not only about the quantity of livestock that tends to change, but also the quality. The number of animals has generally decreased in the village according to different interview partners. Buffaloes, mithuns and horses are not found anymore in the village itself and the number of cattle has been reduced as well.\textsuperscript{18}

Meanwhile, high-breed jersey cattle increasingly replace local breeds and are kept in permanent stables to increase the milk production. This intensification process goes along with the construction of permanent stables that are subsidized by the government and demands an on-farm fodder base that is rich in nutrients. ‘Guatemala’ and ‘Napier’ grasses were cultivated for this purpose, which consequently changes the former role of the forest as major fodder source.

Figure 12: Permanent stable-feeding system with Jersey cow (own picture: 05.08.2015)

The introduction of a breeding bull from India for artificial insemination purposes was decided as part of the next budget-plan for the village block and is another part in this scheme of livestock intensification (E3, Personal Interview, 12.07.2015). The transition of the livestock system has different implications on the land use system such as for soil fertility on the one hand and on the demand for labour force on the other. The increase of

\textsuperscript{17} For a detailed description of a household substantially based on a stable-feeding system (see Annex 11.4)

\textsuperscript{18} According to statistics, buffaloes and mithuns can still be found in other parts of Dagana district nowadays (see 4.4.7).
agricultural production at the same area of land (intensification) would demand for an adequate soil fertility management to provide sufficient nutrients to the plants. The lack of sufficient organic manure that goes along with this transition raises concerns by two RNR extension officers:

" [...] From Livestock they are increasing the improved one, decreasing the local one. From agriculture side, we are going to increase the production, (laughing) losing the manure. If there is no manure, production will be less" (E2,E3, Personal Interview, 15.09.2015)

They note that an increase in crop production is not feasible if the number of manure-providing animals is concurrently reduced. Farmers would grow 50% high-yield varieties but refuse at the same time to use mineral fertilizer, as of its impacts on soil properties (E2, Personal Interview, 12.09.2015). The prevalent shortage of labour in the region (chapter 5.3) seems to be another important aspect that affects the livestock system in the village. The labour force is no longer available to take animals to keep up a system of forest for grazing and demands for an alternative, more labour efficient system to manage the livestock.

There is a trend towards the introduction of a stable-feeding system with improved cattle breeds in the region and nation-wide. Nevertheless, some farmers, such as F10 still choose to follow a traditional system of on-farm cattle rearing. The cattle on the farm used to be tethered under temporal cowsheds. From there, the animals are taken either to another field plot or will be temporarily released to the forest where they graze freely. Asking F10 about plans to convert this system towards the new permanent stable system, the farmer explicates why he will still keep this conventional system: First he argues, that the cows would like to eat grass which would benefit them. Following his system, he can just take animals to fodder sources without investing much time and labour by carrying fodder to the animals. Only one person is needed to take for example 5 animals at one place under a fodder tree. Cutting the branches of the tree is the only thing necessary before the animals will start feeding themselves. Furthermore, he explicates that people nowadays have very few, mostly one cattle left. The permanent stable system, including carrying grasses to the animals, would not be possible for larger herds, as it would need too much labour time. Another point is, that the cow dung is claimed to be good manure for the soil. In his particular case, he is going to change the actual cowshed in one month after the maize harvest. The animals will be tethered at the respective place to eat up the remains and give manure to the field. In that way he is flexible and may put organic dung as of the actual need. At the current place he is going to cultivate vegetables during the coming winter season and Maize in summer (F10, Informal interview, 30.07.2015).

Summary: Livestock system in transition

Cattle play an important role for the local livestock system, both in historical and actual terms. Besides that, poultry, goats and pigs, and to a lesser extent sheep and fish, are kept by farmers for household consumption and local sales. However, the livestock system in the village seems to be in a transition. A historical system of transhumance of large ruminants, namely cattle, mithuns and buffaloes, using the nearby forest extensively for grazing, has largely disappeared. A part of farmers opt for an extensive system of cattle rearing, using temporal cowsheds and an extensive area around the farmsteads as fodder base for the animals. This system builds on

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Figure 13: Ox feeding from banana leaves (own picture: 01.08.2015)
local cattle breeds that are adapted to biophysical conditions in the region and may be released to stay in the jungle without a herder. Water related issues as well as changes in demographical patterns and associated labour shortage were mentioned as possible reasons for an increasing shift towards an intensified livestock system that builds on permanent stable-feeding of improved jersey cattle breeds for dairy production. The fodder base is shifting from forest resources towards on-farm fodder grasses such as ‘Guatemala’ and ‘Napier’ grasses. This intensification process shall enable farmers to get higher milk production with a lower number of animals. The general process of livestock intensification raises questions of soil fertility management due to a reduced amount of organic manure that is solely used to increase agricultural production. Furthermore, this system shall meet the requirements of farm households that face a lack of labour force and which thereupon focus on an intensification of a low-number, high-yield approach.

5.2.3 Rush for the black gold: Short-term profits and long-term risks

“In our field there is no more space except for cardamom. Even in the paddy field I have just planted the cardamom. Even in my dry land I have already planted cardamom” (F1, Personal Interview, 14.09.2015).

Cardamom is the main cash crop in the village of Tashithang. The fruits of this plant fetch high sales-prices and these beneficial economic returns are a strong incentive for a livelihoods strategy with an increasing focus on this crop. Human-wildlife conflicts, labour shortage and ecological conditions are further reasons for farmers to choose this strategy. However, the prices for the cash crop are volatile and depend on external markets and are difficult to predict. The logic of the market, following offer and demand, may potentially lead to a fall in price in the future and makes farmers vulnerable that focus on a single-crop strategy.

In this chapter I put a focus on the relevance of this high-value cash crop for the local land use system. First (5.2.3.1) I explicate framing conditions of the increased focus on this cash crop. After that (5.2.3.2) I present the perception of farmers who focus mainly on the production of cardamom as their main livelihoods strategy and will try to find reasons behind farmers’ decisions. Finally (5.2.3.3) I address some of the risks and vulnerabilities, both in ecological and economic terms that emerge following this land use practice.

5.2.3.1 Focus on large cardamom

Large cardamom (lat. *Amomum subulatum*) is one of the main cash crops in Bhutan, mainly cultivated in the south-western region of the country. The districts of Samtse, Chukha, Dagana, Tsirang, Sarpang and Trongsa are the major cardamom areas in Bhutan. The plant, which belongs to the family of *Zingiberaceae*, is grown only in Nepal, India and Bhutan. The cardamom seedpods are used as a spice in masala and pan masala products in India as well as in ayurvedic medicinal preparations due to its large number of medicinal properties (MoAF, 2016).
Cardamom plants can be harvested after minimum 1–2 years. The propagation is either done via sprouts from existing plants or by plants raised from seeds. In the latter case the plants need 2–3 years until the first fruiting. Cardamom is not an easily perishable good and once the seedpods are dried over open fire, they can be stored for 5 years without losing their quality. In that way, farmers can speculate and wait until prices are high. But usually they are not able to do so, as they need immediate financial resources after the harvest to buy necessary goods (rep (Goshi), Informal Interview, 09.07.2015).

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardamom [Metric Tonnes]</td>
<td>2,122</td>
<td>1,055</td>
<td>442</td>
<td>1,163</td>
<td>650</td>
</tr>
</tbody>
</table>

Table 13: Cardamom production in Bhutan (adapted from SYB, 2013: 83)

Table 13 illustrates the annual production of large cardamom in Bhutan, which showed a strong decline and high fluctuations for the years of 2007–2011. This statistical data seems to correlate with the local situation insofar as a cross-national epidemic disease wiped out a majority of cardamom plantations in the region, leading to a decline in production from 2007–2009. The current dominance of the cash crop is said to be a very recent phenomenon. It restarted in 2012–2013 and experiences a renaissance in these days:

"Before, nearly nobody has cultivated cardamom. Now almost 100% emphasize on this cash crop. They even plant it on paddy-land. Before they only cultivated it on dry land. This happened due to the tremendous increase in cardamom prices in the last years. It just started 2012 when all started to cultivate. Before this, a few already had cardamom cultivated. Before 2012 the people planted paddy and other crops" (F10, Personal Interview, 12.07.2015, translated).

With this statement, the village underlines a strong trend of the farmers to focus on cardamom as their main cash crop only in recent years. Just at the time of the field study in July and August 2015, many farmers were still occupied with the replantation of cardamom by taking sprouts from one field plot to another and extending the already large area under cultivation (Personal observations).

On average, 0.81–1.215 ha of land per farm household are now cultivated with cardamom according to E2. The RNR officer claims that cardamom area already constitutes for around 50% of the total land area under cultivation in the respective village (E2, Personal Interview, 11.07.2015).

The cultivation of cardamom has, although in a much lesser extent than today, a tradition in the village of Tashithang. F8, the richest man in the village according to different references, has started his cultivation of cardamom, as one of the first in the village, in 1965. At this time, before the era of roads and easy accessibility to markets, intermediaries, so called middlemen, already used to come to the villages to collect cardamom seedpods from the cultivators. In case that the price, offered by these people, was not good enough, he used to carry his harvest on a 2–3 days ride to Kalichola or Gelephu to one of the formerly nearest exit-points at the border to neighbouring India to sell his produce. Nowadays, F8 himself works as a middleman for cardamom in the region, which makes him a rich and influential person in the village (F8, Personal Interview, 01.10.2015, translated).

Until 10–15 years ago farmers used to plant cardamom in the region to a smaller extent when prices were still comparably low. Only in the years between 2007–2009 it happened that a cross-national cardamom disease, like an epidemic, has wiped out most of the orchards in the country. This was when people stopped growing cardamom. Now, three years after the plantation of cardamom has started again, the situation in the region seems to have changed. The resumed cardamom production in the region got supported in 2013 by the government and the World Bank, which provided seedlings of an improved variety that should be more robust against potential pests and diseases to farmers who have lost their orchards due to the disease. The variety provided is called 'Barlangey' and F10, who has a small nursery of these plants on one of his field plots, claims
that this variety would have large fruits and would gain a high price on the market. At the same time he notes that the plant would need more care compared to the local varieties. It would need more water, manure and more frequent weeding to grow well (F10, Informal interview, 03.08.2015).

Besides the introduction of a new variety, the cultivation practice of cardamom has changed as well. Cardamom is a shade-loving plant and grows best under 50% shade (MoAF, 2016). Currently there is a trend among farmers to grow cardamom under open areas, without or only few shade providing trees (see Figure 15). Large mono-cropping fields of cardamom plantations are found in the middle altitude of the village and often lack totally in shade providing trees (Personal observations).

Figure 15: Cardamom plantations in open area (own picture: 11.07.2015)

According to E2, an RNR expert in the region, not all of the farmers are managing their cardamom orchards in a proper way. Different aspects (see Figure 16) need to be considered according to the extension officer:

**Clearing / Weeding:** The cardamom plants should be cleared from bushes and weeds in order to support their growth at least twice per season.

**Manure:** Proper manure management should be done. Now the farmers use cattle manure for this purpose. Some farmers also support the plant by using Tite Pati (Artemisia sp.) for mulching purposes.

**Irrigation:** Depending on the altitude, the soil and the water availability need to be considered. The plants should have enough water during the whole year.

**Shade:** Cardamom is said to grow better under 50% shade. It is a shade-loving plant. But due to farmers’ experiences, they now cultivate the plant sometimes in open areas, as well as with little shade of 'Tite Pati', the above-mentioned Artemisia species (E2, Personal Interview, 15.09.2015).
Yields and life expectancy of the cardamom plants tend to be lower nowadays. Whereas plants have reached 15, 20, 30 or even 40 years in the past with less effort in terms of labour and farm inputs by farmers, the current life span was said to lie between 2 and maximum 7 years before the farmers need to uproot the plant and replace it with another. One farmer claimed that cardamom cultivation in combination with trees, as it was done before the ‘big disease’, would not work anymore. He assumes that trees would support the spreading of the disease, which makes them die after only 1–2 years. Additionally, the roots of trees, especially with big crowns, would compete with the cardamom roots for water (DBD, Informal Interview, 25.07.2015). On the contrary, cardamom plants can reach at least 5–6 years under open area before they need to be uprooted (ibid). F2 claimed that the yields of cardamom have been very high around 10 years back. Nowadays the plants would get 7–8 years before they die.

Furthermore, the replantation, which is currently hard work by digging holes and planting the sprouts, has been very easy. Farmers used to put the sprouts on the ground where they easily mounted by themselves after rainfall (F2, Informal Interview, 28.07.2015). A wide range of different experiences were made by farmers according cultivation practices in cardamom plantation that indicate an occurrence of a pest or disease that diminishes the life expectancy and yields of cardamom plants alike. Replanting, weeding, irrigating, manuring and harvesting (see Figure 16), demand for labour resources during the cardamom season in summer from June till November, which are increasingly rare in the farm households. Nevertheless, farmers expand the cardamom area. I argue that the resuming of cardamom orchards in the village may be framed as an interrelated process of extension and intensification attempts with the aim to increase the overall production. On the one hand, the overall area under cardamom cultivation gets expanded at the expense of cereal crops such as maize and paddy that bring less economic revenues and are more labour intensive. On the other hand, existing plantations demand more attention and resources in terms of time and farm inputs, compared to former times.
Summary: Focus on large cardamom

Farmers in Tashithang increasingly focus on the production of large cardamom for export markets. Plantations of cardamom have already been planted by a small group of farmers as early as 1965. An epidemic cross-national disease wiped out cardamom orchards in the region between the years 2007 and 2009. People started only recently 2012 / 2013 again to reanimate old and start with new plantations. This time, the cultivation got supported from the government and from the World Bank, which delivered an improved variety to farmers who lost their orchards. Farmers test this new variety at the moment together with local varieties. Besides that, there is a trend among farmers to change the cultivation practice of cardamom. Nowadays, farmers grow the shade-loving plants also in open areas, without protection from shade-giving trees. Farmers claimed that the general efforts to produce cardamom are also higher these days, including higher farm inputs (manure, water), higher labour input (e.g. weeding) and additional replanting due to dropouts of infected plants. A general trend in the current cultivation of cardamom can be framed as an attempt to increase the overall production of cardamom by following two strategies. First, replacing cereal crops and even kitchen gardens to extend the area of cardamom. Second, a higher input in terms of labour time (e.g. weeding) and farm inputs (water, manure) compared to former times.

5.2.3.2 Farmers’ motivation to expand the cardamom production

Many farmers in Tashithang focus on the cultivation of cardamom as their main livelihoods-strategy. In Interviews they mention different reasons for their decisions. The high economic return related to cardamom production was mentioned by all 9 interview-partners to play a major role. Apart from generating cash income, the ecological suitability of the region was noted as reason for holding on to the crop. Furthermore, the human-wildlife conflict, which concerns mostly for cereal crops, was indicated as another factor contributing to an increasing shift towards cardamom. And last but not least the shortage of labour got related with the trend of farmers to abandon the cultivation of cereal crops and extend the cultivation area of cardamom.

High economic return

A tremendous price increase was pointed out as major reason for the dominance of cardamom as a cash crop, which lead to a real ‘gold rush’ in these days since 2013. In the bygone year 2014, farmers claimed that they could gain around Nu. 1800 (= 25 €) per kilogram, whereas the average harvest in the village was estimated between 160 and 200 kg per household, leading to average revenues between Nu. 288.000–360.000 (= 4000–5000 €) per farm household and year. In the current year 2015 they even estimated prices reaching Nu.2500 (= 35 €) per kg. This price shooting linked to incomparably high economic revenue seems to be a very strong incentive:

“My father is telling that he is focusing more on cardamom because there is advantage over advantage. [...] All people are focusing on cardamom, no? Because in that is a good economics, a good money income. Income for family, for society. When some people become [sic!] problems, money problems, in that time also he want to help, he is talking about that. When his child [sic!] are at the school, that time also he want to help with money for students, to buy books. When he is planting maize, that time maize never help like that [...]. When he is putting cardamom, that time income comes more that time, his family also becomes happy” (F6, Personal Interview,09.09.2015, translated).

The high economic return that can be generated via cardamom cultivation, gives farmers the opportunity to raise their standard of living. A young farmer from a neighbour village illustrated a fundamental link between cash-crop production, money and land use change that he perceived: in his village, that is only few kilometres away from Tashithang, the economic condition for farmers is less related to cash-income. Many farmers are still dependent on subsistence farming in Phuensumgang whereas farmers in Tashithang, who focus more on
cardamom, are able to afford extraordinary food or big mobile phones. Even in his village, people would slowly realize the meaning of money. In earlier days they did not care about that. The farmers used to gamble with money, as they did not have any other purpose for it. They used to play a game by throwing a number of shells on the ground. One wins or loses money in this game depending only on the number of shells that lie face up (VD, Informal Interview, 08.08.2015).

Ecological suitability
Besides the convincing economic return, F5 highlighted the ecological suitability of the location to be an important reason for the cultivation of cardamom in Tashithang area:

"[...] Suitable climatically, soil wise, altitude wise is suitable for cardamom. And then - income from cardamom is quite high, ok? Even 1 acre. Even if one gets only 1 kg is quite high – income is quite high. From the maize, the income is minimum. From potatoes, compared to cardamom is very down. The income if you work out in percentage, it will be like income from potatoes and the cardamom is 5 to 100 % difference" (F5, Personal Interview, 16.09.2015).

The elected leader (Gup) of Gesarling geog furthermore argued that climate change could be a reason why farmers shift their cultivation pattern away from paddy and search for alternatives. He added that in 2014 there was insufficient rain for paddy cultivation (Gup, Personal Interview, 07.09.2015). This evaluation was also confirmed by a RNR officer who argued that climate change induced alteration of rainfall patterns would severely affect agricultural production in the region (E4, Informal Interview, 20.07.2015).

Human-wildlife conflicts also play an important role for agricultural land use change in the village and the project region. An elderly farmer addresses this critical issue for farmers that seems to put a constant threat on the cultivation of cereal crops and gives them another incentive to focus more on cardamom:

"If I put maize and paddy, it is possible that wild animals eat them. That is why I am focussing on cardamom because it is not endangered to be eaten by wild animals. That is why I hope that we get income from the cardamom fruits" (F1, Personal interview, 14.09.2015, translated).

Farmers in Tashithang still opt to guard their field crops 2-3 months before harvest in order to protect them from wild animals. Distinct from other villages in the region that focus mainly on technologies like barbed wire or electric fencing to ward off wild animals, these adoptions seem to be no big issue in Tashithang so far. Scare crows (see Figure 18) and local fences, made from bamboo or stones, are still used to protect cereal crops. Three types of animals are mentioned for their potential of crop depredation. Monkeys enter into the fields during the day, whereas wild boars and wild deer damage crops only during night-time (E4, Personal Interview, 11.07.2015). Monkeys are furthermore a threat for mandarin orchards in Tashithang, according to a farmer (Informal Interview, 11.07.2015). It seems like farmers would rather turn their focus on the cultivation of cardamom instead of holding on endangered crops that need to be protected more intensively from wild animals.

Figure 18: Scarecrow in lower Tashithang to ward-off wild animals (own picture: 24.07.2015)
F7, an elderly couple, stay in a remote part of the village near to the forest and has planted only cardamom on their fields, except a small kitchen garden. They claim that their land is simply not suitable for the cultivation of cereal crops such as paddy or maize. As a major reason, they perceive the constant threat of human-wildlife conflicts for their cereal crops near to the forest. In their case it is especially the occurrence of monkeys that would damage maize and paddy fields and give them another reason, apart from economic advantages, to focus on cardamom to sustain their livelihoods. With the money from cardamom, they are able to buy rice from the shop, which is more convenient for them (F7, Personal Interview, 13.09.2015).

The critical issue of labour shortage that is prevalent in the region and the country as such appears to be another driver in relation to current land use practices and for the cultivation of cardamom. A generally low number of permanent household members in combination with low availability of workforce and high labour costs demands for strategies that need less labour input and can guarantee a high economic return at the same time. The cultivation of cardamom seems to be an appealing option to use available workforce to generate a sufficient income.

Figure 19: Weeding in cardamom orchards by a group of hired workers (own picture: 16.09.2015)

Summary: Farmers’ motivation to expand cardamom production

Farmers in Tashithang mentioned different motivations for a focus on cardamom production. All interview partners named foremost high economic profitability as important reason for their decision. A price surge from 2013 onwards was a strong incentive for the shift towards cardamom production. Farmers regard the village a suitable place in ecological terms for the cultivation of cardamom due to its north-sided exposition, associated high moisture of soils as well as climatic and altitude-wise suitability. Human-wildlife conflicts seem to be an implicit reason for farmers as it puts a constant threat on farmers’ field crops that need to be protected from wild-animals. Cardamom production is to a lesser extent threatened by wild-animals and this gives another incentive to shift towards cardamom. Finally, the prevalent labour shortage in the region of Tashithang, leading to high labour costs, affects farmers’ decisions to cultivate cardamom instead of cereals. Cardamom production is mainly a seasonal task but still needs labour resources that are managed by the farm households. Household labour, service exchange and hired labour are different organizational strategies to allocate sufficient labour resources and get increasingly complemented by the use of farm inputs and machinery to lower the need of labour force.
5.2.3.3 Risks and vulnerability

"Yes, it's very risky. Risky farming what I see. [...] So if the price of the cardamom still remains constant, then these people will be gain in any way. But sometimes if the price of cardamom drops, then it is a very big risk for them. Because whatever the field, whether it is dry field or wet field, paddy field, they are all cultivated with the cardamom no? If once the price fell, they have to uproot all the cardamom and again have to start their new farming system and cultivating this maize, paddy and all these things. So it is a big risk. Still I right now I cannot say exactly, but I wish that they should not be go in monoculture, mono cultivation type, no? [...] Otherwise they are, sometimes this cardamom, this cultivation of cardamom seems like it is a gamble. They gamble" (E4, Personal Interview, 19.09.2015).

The economic benefits of cardamom cultivation for the farmers are undoubtedly high. However, economic, as well as ecological and social risks seem to become apparent related to this dominant land use practice and indicate vulnerabilities in following a single-crop approach. The year of field observations (2015) has been the peak of cardamom cultivation in the village until now and started only few years back. E4 claimed that farmers have considered many different aspects, such as altitude, weather, soil or shade, when they planted cardamom in the past. Today in comparison, they would not consider anything. They would just cultivate cardamom everywhere. This happened, according to him, mainly due to the price surge, starting in 2013 (E4, Personal Interview, 06.07.2015).

Economic risks

The high price that farmers can gain currently via the cultivation of cardamom fluctuates according to market conditions (F5, Personal Interview 16.09.2015). These fluctuations are difficult to predict, which creates a strong dependency of the farmers towards external markets. However, farmers seem to orient their cultivation patterns according to actual prices that follow market conditions of supply and demand (Personal observations). This situation appears to make farmers vulnerable for unpredictable changes in market conditions and may also lead to a major loss of income for them. Current land use decisions with an increasing focus on a single-crop strategy seem to consider especially market conditions and may hamper diverse and ecologically adapted land use practices.

"No price fluctuation like that of cardamom. Now cardamom, now this year is 70.000 for 40 kg. Maybe from next year it might drop to 40.000 for 40 kilo. There is a high fluctuation of prices of cardamom" (F5, Personal Interview, 16.09.2015).

The farmers’ experience of a volatile cardamom market was confirmed in the year 2016, when the price dropped from Nu.2000 (≈ 28 €) in 2015 to Nu.700 (≈ 9,7 €) in 2016, according to an employee of the National Biodiversity Centre in Thimphu (Sangay, Informal Interview, 14.06.2016). This high price fluctuation in cardamom market seems to contain an economic risk for them as it is directly linked to expectable cash income. Money is needed by farmers to afford necessary investments in agricultural production (seeds, irrigation facilities, pesticides, hired labour, etc.) for the following season, to afford different goods of modern lifestyle (e.g. television set, mobile phones, etc.), but also for basic commodities and education of children. The economic vulnerability that appears in this relation might become especially relevant when farmers are not able to afford or maintain these goods anymore due to a kind of shock or crisis. Once the cash flow from valuable crops, such as cardamom, dries out, farmers would need to find other profitable ways to afford the newly adopted lifestyle fuelled currently by cash from cardamom production.

Ecological risks

Different ecological risks go hand in hand with the cultivation of cardamom. There is the risk of pests and diseases that affect the cultivation pattern and might be even a significant threat for rural livelihoods that depend on this single-crop strategy. After an epidemic-like disease has wiped out the majority of orchards only one decade ago, there is a risk that the disease either remained present in the area or will return in future.
Referring to research documents on large cardamom, it is likely that it was a disease called *Colletotrichum* blight, caused by a fungal pathogen, that destroyed the large cardamom plantations in the country and seems responsible for severe crop losses in the recent years (MoAF, 2016). F10 raised the point that a possible return of the disease might affect farmers in Tashithang seriously due to their economic dependence and could push them even into poverty (F10, Personal Interview, 12.07.2015).

Currently, both cash crops in the village seem to be endangered from pests and diseases that force farmers to adapt either by using phytosanitary measurements or changing their farm management such as in the case of cardamom by growing plants under open area or introducing new, more resistant plant varieties. Albeit the farmers have faced the loss of their cardamom plantations only one decade ago, they put their focus again on the cultivation of this crop and seem to prefer monocropping cultivation. An elderly couple of farmers claim that the same disease that has once wiped out all orchards has already returned to the region and spreads in the upper parts of the village. In case the disease would affect their own fields again, they claimed to uproot the plants and turn back to grow cereal crops such as maize and wheat. This shift would be easily possible with cardamom compared to mandarin trees that cannot be removed so easily (F7, Personal Interview, 13.09.2015).

![Spraying pump used for phytosanitary measurements](own picture: 30.07.2015)

Other farmers try to spread the risk of cardamom production by counting on different economic pillars. This may be done by counting on off-farm employment such as wage labour in contract working or road construction, which is done by the family of F9, or by growing different agricultural crops, as in the case of F6 who wants to count on different agricultural crops to spread the risk of a potential crisis:

"There is no risk from my father’s side. Cardamom dies - so my father has planted oranges also, so he want to earn from that side also. So my father again telling, if any risk dies [sic!] this cardamom tree, so my father is telling that we want to get help from agriculture side, like that. [...] If disease catch up and if, we blight orange also, if that also not work, he want to plant Maize also (laughing) again he really stuck for Maize. [...] After that this is not working he stopped to plant everything. After 4-5 years again he want to start [...]" (F6, Personal Interview, 09.09.2015, translated).

Pests and diseases appear to be a threat for the continuation of the current livelihoods strategies. Citrus orchards are presently endangered in the whole production areas whereas farmers in the region also report signs of a disease return in cardamom plantations in their village. Farmers currently expand the existing area of cardamom and prefer monocropping cultivation practice under open areas to avoid immediate dropouts. However, the propagation of cardamom on even larger area might further promote the transmission of pests and diseases and increases the risks for farmers and community to lose their valuable orchards. An epidemic-like disease as it already happened only one decade ago could immediately put an end to the trend of cardamom extension. As the village head claimed, such a dramatic event could even push farmers into poverty that build mainly on a single-crop strategy.
Another conflict in relation to ecological sustainability and cardamom cultivation is the demand of water. Irrigation of orchards in times of general water scarcity during the winter season seems to indicate a conflicting use between drinking water, animal feeding and the need of irrigation as addressed by F1.

“There is no water. Just now, the water is available everywhere. The rivers and fountains are filled right now, but during the wintertime, which is the main time of the water needed, there is no water available. Because of this lack of water, the cardamom does not grow well. Nowadays you have seen a lot of water everywhere, isn’t it brother? During the winter time we don’t even have enough water to give to the cattle” (F1, Personal Interview, 14.09.2015, translated).

Until now, farmers irrigate their cardamom orchards in the winter season only in times of sufficient water availability during night time, whereas vegetables are irrigated rotation-wise among households during the day. According to F10 the water scarcity is a serious issue in the village and has already provoked some farmers to leave their lands fallow (F10, Personal Interview, 12.07.2015).

An elderly farmer claims in this direction, that only one small water source is providing water for the village during the dry season. If the people in the village would have a medicine against plant diseases and enough water, they would not have any problems (DBD, Informal interview, 25.07.2015).

E4 stated that water availability could become a severe problem in the near future. Drinking water sources are frequently drying out during the winter season, which demands either for an investment in high technology pumps and tanks to store and distribute water, or could lead to increased migration of people who aren’t able to sustain their lives due to water shortage. Climate change in general, rainfall patterns changes in particular, were named as causes for this development (E4, Informal Interview, 12.07.2015).

Figure 21: Irrigation channel in Tashithang becoming a rill during winter season (own picture: 02.08.2015)

The drying-out of water sources is also related to another challenging situation that was raised by two government employees: Farmers increasingly try to convert their paddy fields (Chhuzhing) into dry land (Kamzhing). Wetland cultivation is very valuable due to terraced land and artificial irrigation facilities and shall be used for the production of paddy as a food crop from government perspective. Farmers are not allowed to build either infrastructure on it, or cultivate orchards such as mandarin or cardamom (see Land tenure system 4.4.3). However, owners of wetland fields argue that there is an under-supply of water for this cultivation practice and that they need to change its official status albeit the government follows a strategy of food self-sufficiency and tries to keep or even increase the food production in the country. The government officers tell that all proposals submitted by farmers were refused until now. The officials in charge would only measure the water content of the soil and decide on basis of technical measurements whether paddy cultivation would be feasible on the land or not. The reasoning behind it seems to be strongly based on the government strategy to increase the national food self-sufficiency.
"That’s why this people they always want conversion of paddy field into dry land. So, if all the paddy fields are converted into dry land, food self-sufficiency is really questionable, so better left, leave like that. One day or two, this will change, the field will change. The people have to cultivate paddy again" (E4, Personal Interview, 19.09.2015)

E4 relates this quote to the situation in the village that farmers use their paddy fields in an unintended way by cultivating cardamom even on paddy fields. According to a young educated farmer in the village, the reasoning behind the practical conversion from paddy and maize fields into cardamom orchards is not only due to a lack of water. From his perspective, the farmers try to eliminate their cereal crops more and more due to the high price on the one side, and due to a lack of workforce, that is needed for labour demanding tasks such as paddy cultivation, on the other (Jimmy, Informal Interview, 01.08.2015).

E2 claimed in contrary that there exists already a commitment to solve this water-related problem in the near future. Water distribution facilities for irrigation purposes are planned in form of a second, additional water tank to connect to an additional water source, to solve the urgent need for irrigation of vegetables and cardamom plants during the off-season (E2, Personal Interview, 15.09.2015).

Figure 22: Water distribution tank (own picture: 08.07.2015)

Finally, a loss of agrobiodiversity in terms of a diverse range of plants and animals used for an integrated farming system can be raised as another critical issue concerning ecological risks. Profitable cash crops like cardamom increasingly substitute crop diversity whereas cheap food imports from India are easily available and put additional pressure on the low-value staple crops.

Social risks
Finally, besides economic and ecological risks for sustainable rural livelihoods, risks related to social cohesion and equality become apparent on a community level. Successful farmers have already earned large amounts of money by cardamom production and give a proof of its economic profitability. These farmers are seen as role models by many people in the village due to their richness that enables them to get farm activities done in a higher extent and speed. This development may drastically change the economic equality among farmers in terms of living standards. Referring to one of the farmers that became rich through cardamom cultivation only recently in the village, F1 raises this point of a money-driven business that gives rich people incomparable amounts of resources on hands:

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19 Definition of agrobiodiversity: The variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fibre, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems.

Source: (FAO, 1999)
"If there is money, any kind of work will be done. Right? Again, Mon Dan Sherpa, how many different works he ordered to do last year. At this time, he also had a lot of money, because of that he was just able to order (the work). He also paid the workers. If there is only a small amount of money, we will not be able to order workers. [...] We do not have so much money that is why we are not able to order work in that way. Because he has a lot of money, that is why he can order the workers.”

(F1, Personal Interview, 14.09.2015, translated)

This accumulation of wealth and associated questions of equality are also related to the role and upcoming of merchants from in-, and outside of the village, termed middlemen by interview partners. Some of these merchants are present locally in the region itself, whereas others come from different parts of the country to follow a lucrative economic model of commodity trade. In the project region this business model is mainly done with cardamom and mandarin, and two main players for agricultural commodity trade are present on a village as well as on a higher regional level (E3, Personal Interview, 19.09.2015). Here I want to raise a few important aspects according the role of these middlemen for the local community. Middlemen in the region are usually rich people who started a trading business with agricultural commodities destined for export markets. The main trading point for products from Tashithang region is currently Phuentsholing, a region of Bhutan bordering to the Jalpaiguri District of the State of West Bengal in India, from where products such as cardamom and mandarin are sold to foreign buyers by registered commodity traders from Bhutanese side. Middlemen seem to fulfil different roles and have influence on the local land use system. First of all they act as primary traders that buy produce directly from farmers in order to sell it at higher prices to other merchants or to officially registered commodity traders by gaining a high profit margin.

On a local level, these merchants also comply an additional role. A government employee states with regard to them: The whole area belongs to them. [...] They feed the whole area out here, two or three months” (E4, Personal Interview, 19.09.2015). Farmers in the region tend to be unsustainable in the sense that their food and financial resources are usually exhausted after only 8–9 months. After that, they need to recover their (food) stocks by asking rich merchants, who have enough surplus of money or food, to help them out. Additional reasons for borrowing money from rich merchants may be urgent needs of farmers like sending their children to college, investing in machinery, etc. In that way, the farmers are already bound to these patrons to pay back their debts. When the season of harvest arrives, they need to sell their produce to the particular sponsor instead of selling it somewhere else at a higher price. Additionally to that, merchants work like financial institutions and often demand interest for their offerings. Depending on the amount, the interest rate lies between 2-5% monthly, according to a government employee. This high interest rate would “kill” farmers and would make merchants very rich (E4, Personal Interview, 19.09.2015).

A young farmer in the village claimed that his father has sold the last year’s harvest to one of these local middlemen. When the son asked him, why he would do so rather than selling it personally at the border, the father answered that ‘money is nothing’ and that the harvest was good in the particular year, but maybe next year there will be no cardamom at all and then they would need the help of this person to afford certain things (KR, Informal Interview, 19.09.2015).

This story underlines different roles that the middleman seems to comply in the community. Additionally to the role of a trader, he seems to serve as a safeguard for farmers in times of crisis. The loss in profit that the farmers bear, guarantees the profitability for the middleman and is also linked to a fixed, calculable price and a security in times of trouble for the farmers.

Nowadays the number of middlemen increases according to a government employee. The number has gone up to 12–18, which changes negotiations between farmers and merchants. This development drives the competition among middlemen and enables the farmers to gain a higher price for their produce (E4, Personal interview, 19.09.2015).
Lucrative cardamom business seems to contain social risks according to economic equality and living standards among the community members. One major risk seems to be the accumulation of money among a small group of increasingly influential people. The 'success stories' of people that became rich due to cardamom production, might be an incentive for farmers to opt for the same path of intensive market-driven commercialization of agricultural products. The complex role of middlemen in the village seems to be also linked to this process. On the one hand middlemen serve as a safety net for farmers in times of economic shocks and crisis. In this sense, it may be argued, that they reduce the risks of farmers by bridging the time gap until the following harvest by providing money or food to the farmers in need. On the other hand it seems, as they would accumulate wealth at the expense of farmers due to a high trade margin and additional interest rates. From this perspective they would rather increase farmers' dependencies by taking high interest rates and profit margins from their produce.

Summary: Risks and Vulnerability

The current trend of cardamom production in the village seems to be linked to risks in economic, ecological and social terms. Economic risks are related to fluctuations in cardamom prices and unexpected decline in prices. Low cardamom prices may have severe implications for livelihoods on a household and community level. Current household needs related to cash income from high-value crops comprise investments in agriculture, basic commodities, vehicles, (private) education for children and further more. Ecological risks appear in terms of pests and diseases that might affect the orchards and result in crop failures as it has happened only one decade ago. Such a severe case, the village head claimed, could push farmers that build mainly on this strategy, into poverty. An additional demand of water for irrigation purposes during the dry winter season is another risk for both, the continuation of cardamom production and for conflicting uses of drinking water and animal feeding. A proposal for a new water tank and pumps for irrigation purpose shall solve this problem and reveals also the future trend towards irrigation of intensive cash crop production. Finally, social risks are difficult to label, but seem to appear on a community level in relation to an increasing commodification pathway. Risks might occur due to an increased process of money accumulation among a small number of rich farmers and middlemen. The commercialization of agriculture, seen as a role model in the village, may put an increasing pressure on ecologically sustainable cultivation practices and are in large part oriented towards market conditions. The role of middlemen in the villages seems to be important for the continuation of cash crop production and provides different lines of argumentation according to social risks. Middlemen seem to be rich and influential people who make profit by high margins and additional interest rates from farmers. At the same time, they are social institutions that serve as a safety net in the village and might mitigate shocks and crisis for farmers by providing food and or money in times of need.

5.2.4 Nuts for development - Contract farming in Bhutan

Cash crops play an essential role in Tashithang. Besides the dominance of cardamom cultivation, new cash crops, namely kiwi, hazelnut and apples are on the rise and might put further pressure on the cultivation of traditional subsistence crops. The private venture mountain hazelnuts is the first 100 % FDI (foreign direct investment) driven project in Bhutan that builds on a 30 year contract between the RGoB and FDF company (F5, Personal Interview, 16.09.2015). The project started in 2005 in the district of Mongar in eastern Bhutan before it was extended to other Dzongkhags in the western part. The project was recently introduced to districts of Trongsa, Dagana and Chhukha (E4, Personal Interview, 19.09.2015). When the venture started in 2005, it was planned to set up plantations only on degraded land. This initial idea has now spread further and plantations will be extended to all Dzongkhags in which, ecological conditions appear feasible for plantations (E6, Personal Interview, 14.08.2015). In that way hazelnut orchards were claimed to have a potential, like other cash-crops meant for commercialization, to replace traditional subsistence crops of farmers. This might put a threat on
questions concerning agro-biodiversity and national food sustainability, according to an agricultural expert of RNR Yusipang (ibid).

In 2015 this new business model also arrived in the watershed area, including Tashithang and develops additional dynamics on land-use change and rural livelihoods especially in relation to commodification pathways and potential loss of agro-biodiversity. 7 farm households in Tashithang, who own fields at 1600 MASL and above, have already made contracts with the company and started or decided to start in near future with plantations.

**Contract farming and value chain**

Hazelnut cultivation in Bhutan is carried by FDF Company, a private venture that started a long-term investment in sustainable agribusiness in the country and takes control over large parts of the value chain of hazelnut from plant delivering, support and monitoring by trained extension people, till transport and marketing of fruits. The company is also planning to build a factory for further processing of fruits to sell hazelnut cream for cakes, pastry, etc. (ES, Personal Interview, 16.09.2015)

The production of hazelnut fruits is organized in the following way: In cases where ecological conditions, mainly the altitude of fields above 1600 MASL, is fulfilled, interested farmers get necessary equipment, such as saplings and mulching sheets from the company free of cost but have to purchase mineral fertilizer that is needed in small amounts for the first three years. Additionally, farmers are responsible for fencing their fields to protect them against wild animals and roaming livestock. Two varieties of Hazelnut saplings are available. They are propagated via tissue culture in the US and China and arrive in plant nurseries of Mongar / Eastern Bhutan. From there, plants are taken to Bumthang / Central Bhutan to get adapted to cooler climates. Seedlings are distributed from there to farmers in different parts of the country (ES, Personal Interview, 04.10.2015).

The varieties are claimed to be high yielding and even robust against frost and different types of pests by a staff of FDF company. The cultivators get further training and instructions on how to plant and nurture the plants (hc, Informal interview, 30.07.2015).

Two extension people are constantly in charge for Gesarling and Goshi geog including Tashithang village and are accommodated in Tashithang for at least three years. They monitor the forthcoming of the plantations repeatedly by using smartphones and GPS signals, send reports to the company, and support farmers in all further questions such as irrigation issues or human-wildlife conflicts.

Farmers are responsible for planting and nurturing the plants, as well as for the harvest of fruits. 400 saplings need to be planted per acre (0.405 ha) in a distance of 2x4 metres. Cultivators need to keep the plants free from weeds and are responsible for the protection against wild animals and roaming cattle (E4, Personal Interview, 19.09.2015). A group of farmers, who planted hazelnut and avocado in a mixed-cropping system on a large piece
of land, practiced a way of individual fencing with bamboo sticks for the first year. After that, they would fence the whole area with barbed wire to protect the plants (Jimmy, Informal Interview, 01.08.2015). The first harvest could be done after three years, depending on the care taken by the farmers. After drying, the fruits are taken over by the company for further marketing (ibid).

**Market and prices**

"Yes, yes yes. I started in the Internet and then I felt that it should be much more durable and will have a consistent income. No price fluctuation like that of cardamom. Now cardamom now this year is 70.000 per, for 40 kg. Maybe from next year it might drop to 40.000 for 40 kilo. There is a high fluctuation of prices of cardamom whereas and this hazelnut has commands international market and can go to international market. China, Japan, America, European Countries" (F5, Personal Interview, 16.09.2015).

F5 is currently carrying out subsistence farming and has already started to plant cardamom and hazelnut plantations in a mixed-cropping system. After few years he wants to focus solely on hazelnut and takes out the cardamom. According to him, the price volatility of hazelnut is less than for cardamom cultivation and the labour demand will be also low after some years. The company guarantees farmers a constant price, according to currency fluctuations, and a secured market for their produce at international markets in China, Japan, America and Europe (F5, Personal Interview, 16.09.2015).

Referring to a senior member of the regional extension officers in charge for the venture, farmers get a fixed price of Nu.30 (= 0.42 €) / kg. He claimed that the venture would strategically not pay too high prices to prevent that all farmers leave their traditional farming system due to overwhelming economic opportunities, which would be associated with loss of agrobiodiversity (hc, Informal Interview, 30.07.2015).

**Implications for land-use and rural livelihoods**

Contract farming of cash-crops appears to be a new model in the research site. Due to broad support by the company to provide materials, on-field technical support, a guarantee of fixed prices and a secure market, hazelnut seems to be an appealing option for cash income. A small share of farm households in Tashithang has fields in the required altitude of 1600 MASL. However, 7 farmers joined the venture and started with the plantation of hazelnut trees that might become as old as 100 or 150 years. From this perspective, hazelnut cultivation may reduce farmers’ vulnerability in economic terms due to fixed prices and a secure market in contrast to high price volatility of cardamom. The low labour input needed for the hazelnut orchards may additionally help farmers to reduce their labour demand in times of constant labour shortage.

On the other hand, due to appealing options for individual farmers in terms of economic return and labour costs, hazelnut production might put further pressure on traditional subsistence crops and agro-biodiversity in Tashithang as suspected by an agricultural expert in Yusipang. In comparison to existent cash-crops it shows a stronger orientation towards international markets and may reflect an increasing integration into global market chains and their relevance for land-use issues in Bhutan. Another aspect that seemed to be relevant in this direction is the question of self-determination of farm households that lose control over major parts of their resources to the company during the production of hazelnut. A major part of the value chain of hazelnut production, from plant propagation till marketing and pricing is controlled by FDF Company. Only the plantation, nurturing and harvesting is controlled by farmers but is constantly evaluated by extension people. In this way I would argue, that farmers in Tashithang seem to give away much of their control over important resources and decisions, which could lead to a strong dependency of the farmers towards FDF company.
5.3 Migration and agriculture: The future of rural livelihoods

"Once the road came, these horses disappeared. Then, once the school education, because of education, people started migrating for the services, for different types of jobs, outside in the towns and cities. Because of that [...] the cultivation decreased. When the cultivation, the area of the cultivation decreased, then there are more fallow lands left. [...] They don’t have people to work in the farm. Because of all that, these factors, the scale of cultivation decreased" (F5, Personal Interview, 16.09.2015).

Migration seems to be a major driver for land-use change in Tashithang. Historical and actual forms of in, - and out-migration have been present in the village whereas rural-out migration of educated young people, related to shortage of labour, was identified as major contributor. A shrinking and ageing local farming community in combination with geographical conditions that do not easily allow for a modernization pathway of mechanization, seems to demand for particular land-use strategies. In this chapter I explicate aspects related to education, (rural-out) migration, associated labour shortage and implications for the land-use system and livelihoods. First (5.3.1) I outline forms of migration in the village with an emphasis on linkages between education and rural-out migration that contributes to labour shortage. Second (5.3.2) I will look at labour saving strategies, adopted by farm households, to cope with this situation. This is done on an organizational level by allocating labour resources among the community, as well as on a technological level by using farm inputs such as machinery and pesticides.

5.3.1 Nobody at home - Migration for a better life

Labour shortage was a main topic of land-use change, repeatedly raised by farmers and representatives in Tashithang alike. Traditional demographical patterns of large extended families are not found anymore and the current situation is that usually a couple and, if still alive, the elder generation, live at the farmsteads to work on their fields. Local extension officers claim that two children per household would be enough for most of the families nowadays (E2, E3, Personal Interview, 11.07.2015). This seems to agree with a broader trend in Bhutan of declining total fertility rates from 5.6 births per woman in 1994 to 4.7 in 2000 (GNHC, 2010) and a concurrent reduction of population growth rate from 3.1 % in 1994 to 1.3 % in 2012. The growth rate is estimated to drop even to 0.4 % in 2050 if the current trend continues (GNHC, 2013). A village representative in the watershed area found that a major reason for this was the free availability of contraception and family planning support at hospitals. While families had 10 children or even more before starting of these campaigns, families would currently get 2–3 children (rep (Kana geog), Personal Interview, 05.07.2015).

"Family planning in Bhutan is entirely on a voluntary basis and services are provided free of charge by the state to all individuals and couples needing them. [...] While temporary methods are available at all BHUs and hospitals, permanent methods are currently available only at the hospital level of care" (MOH, 2012: 74).

The policy strategy of family planning support, providing a range of modern contraceptive methods seems to have far-reaching implications for demographical trends on a local and national level. On a local level, the situation of a decreasing number of family members demands for land use strategies from remaining household members to cope with a situation of substantially lower workforce.

An actual situation of labour shortage is furthermore linked to historical and actual migration trends. Emigration of large parts of the local population at the beginning of the 1990s due to an internal political conflict in Bhutan (25 households left out of 80-90) may be seen as a historical process that has long-term effects on demographical patterns with implications also for land use. Apart from that, out-migration of young educated people to urban centers was termed as most important in relation to current processes driving labour shortage.
5.3.1.1 Demographical trends and implications for land-use practices

“There is also the migration problem. Especially the educated youth will not come back to the villages. Same as in the other chiwogs, the situation is that only the old people stay back in the households”
(E2, E3, Personal Interview, 11.07.2015)

Different forms of in-, and out-migration have been mentioned that show various implications for local land-use practices (see Table 14). Here I want to outline major forms of historical and actual migration trends that I found, before I focus on strategies and opportunities of the younger generation that either leaves the village in order to find an ‘easy life’ in urban centers or has to stay back in the villages, due to a lack of resources and opportunities.

<table>
<thead>
<tr>
<th>Type of Migration</th>
<th>Description</th>
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<tbody>
<tr>
<td>(1) Out-Migration</td>
<td>Migration inflicted by political conflict and subsequent resettlement</td>
</tr>
<tr>
<td></td>
<td>Former settlers of Nepali-origin (Lotshampa) that left the region during a political conflict at the beginning of the 1990s (refugees)</td>
</tr>
<tr>
<td>(2) In-Migration</td>
<td>Remigration of people due to appealing economic opportunities</td>
</tr>
<tr>
<td></td>
<td>People who migrate to the village in order to earn money by focusing on high-value cash-crops</td>
</tr>
<tr>
<td>(3) In-Migration</td>
<td>Migration linked to Education</td>
</tr>
<tr>
<td></td>
<td>Students who stay off the village for education / training during large parts of the year</td>
</tr>
<tr>
<td>(4) Out-migration</td>
<td>Students return back to the village; Not qualified for further studies; lack of resources and alternative job opportunities</td>
</tr>
<tr>
<td>(5) In-Migration</td>
<td>Former students who are not able / not willing to stay in the village, leave the village permanently and look for jobs and services in urban center</td>
</tr>
</tbody>
</table>

Table 14: Historical and actual migration movements in Tashithang (own adaptation)

1) Political conflict and out-migration
A majority of people left the region in the 1990s due to an internal political conflict in Bhutan in which people of Nepali ancestry left the country voluntarily or were evicted after episodes of demonstration and civil unrest against the ruling government. This happened when Bhutanese citizens were requested to attest historical residence in Bhutan in form of legal documents, which many of ethnic Nepali people were not able to do (Hutt, 1996). In the particular village this has had far-reaching consequences for demographical patterns when only 20–25 of former 80–90 households remained in the village after that (F10, Personal Interview, 12.07.2015). Farmland got abandoned and is partially still uncultivated nowadays. F4 also noted that large numbers of animals were taken by emigrants either to sell or take them out of the country. The former system of transhumance disappeared in large parts during this time (F4, Personal Interview, 05.10.2015). It was not an aim of this study to focus on this type of out-migration and its implications for land-use in the village, but nevertheless it seems like the conflict, subsequent migration movement and associated legacy effects have far-reaching consequences for the land use system from the time of emigration until nowadays. The role of this out-
migration cannot be evaluated in this study, even though it is assumed to have implications even on current trends of labour availability in the village. For further readings on the topic I refer to (Hutt, 1996) for a general description, perspectives and implications on the internal political conflict in Bhutan during the 1990s.

2) Resettlement
This far-reaching demographic change activated a subsequent process of immigration by Bhutanese citizens from other parts of the country. This development started in the project region from 1995 onwards (rep [Kana geog], Personal Interview, 05.07.2015). Only in 2002 resettlers arrived in the village of Tashithang where they usually got ≈2 ha (5 ac.) of land granted from His Majesty the King, which they could use to make a living. There were additional loans given to resettlers by the government to support the building of dwellings (Gov.employee, Personal Interview, 07.09.2015). The land was given to them by lottery but could be swapped in certain cases of discontent (ibid). Farmland, once cultivated by Lotshampa people, was partially redistributed to newly arrived people in order to meet their need for land. In Tashithang, 17 households were established by resettlers, comprising for 24% of the total number of households. A process of interrelated adaptation happened between native settlers and newly arrived people concerning agricultural practices and cultural traditions (F10, Personal Interview, 12.07.2015) in which those resettlers even achieved to compete with native settlers in terms of agricultural production (Gov.employee, Personal Interview, 07.09.2015).

Figure 24: Immigration of resettlers manifests in diversification of local architecture. Above, traditional clay-house by native settlers; below, house of resettlers (own pictures: 11.07.2015; 05.07.2015).
A positive co-adaptation process among native settlers and immigrants has happened in the village with interrelated learning processes also in the field of land-use, according to representatives. However, the situation in Tashithang was highlighted as a positive example for this process by a local authority of Gesarling geog. In Gesarling, which includes more villages than only Tashithang, resettlers account for about half of the totally 219 households and several challenges have appeared that are related to immigrants that have come to the region. A lack of knowledge for the new farmland and land-use practices would often result in low yields for those farmers. Additionally, there are concerns of strong alcohol abuse among immigrants as well as a lack of willingness to do farm work, which also leads to the selling of land soon after their arrival (Gov. employee, Personal Interview, 07.09.2015).

3) Remigration due to economic opportunities

“So if you stay in here, now they are a little bit because of Cardamom they are coming and doing some work. Otherwise, no work. No [...] chance to get the money no? You have to make money. No factory. Nothing else. All the institutes are setting up and down and they are going for to search a job [...]”

(E3, Personal Interview, 15.09.2015)

E3 highlights the economic options that arise for young people from the cultivation of cardamom production and indicates an absence of alternatives. A demographical trend, related to this situation may be framed as rural in-migration that was provoked by appealing economic opportunities from high prices in cardamom production. People return to the village with a preferential aim to focus on commercialization of cardamom to achieve a high economic return. One such case is a young educated entrepreneur, who returned back after completing a higher education in India and is seen as a role model that has new innovative ideas and brings development to the village (F3, Personal Interview, 6.10.2015). The young man got attracted by high prices in cardamom production and decided to leave the city and his former job in order to start a cardamom business with the aim to generate a high cash income. This livelihoods-strategy seems to differ strongly from traditional subsistence-oriented farming practices and is mainly oriented to generate a maximum cash income. Jimmy, a young man who usually studies in India claimed that he would currently observe people from different backgrounds, such as drivers, teachers or entrepreneurs, who return back to the village in these days either to take over land of their families or by purchasing land. He mentioned that the government tries intensively to make the rural area more attractive, especially for youngsters who have dropped out from school and should be motivated by attractive loans and different kinds of support to make a living from agriculture (Jimmy, Personal interview, 01.08.2015).

4) Education and the lack of labour

According to official documents, education is of highest priority for the government of Bhutan in order to reach the overall goal of gross national happiness. The share of net enrollment of children has reached 96% nowadays, which means that nearly all children at age attend school (MOE, 2014). In the here presented context, I want to point out interrelations between education of the young generation and questions of rural out-migration, labour shortage and subsequently the continuation of farming as a livelihoods-strategy in remote rural areas in future.

(Gordon, 2013) asks in a paper about current educational challenges in Bhutan if and how the current education system may contribute to the emptying out of rural areas because of better schooling conditions in urban centers, and because work in the countryside is perceived as unimportant and degrading. With the aim of a maximum enrollment of children in schools from 6 years on (class pre-primary), there seems to be an implicit preference from the RGoB to promote institutionalized school education in favor of an education that can be rather termed as farm-based and inter-generational.

General education in Bhutan is not compulsory but is available for every citizen in Bhutan and takes in total 11 years with 7 years of primary (including pre-primary), and 4 years of secondary education. The schooling system is divided in three phases (Ugyen and Cokl, 2010):
Phase I: General education (11 Years) from class PP (6 years) to class X (15 years).
Phase II: Higher Secondary School (class XI - XII) and
Phase III: Three years of tertiary education.

Beyond the 10th grade students either continue their general education in classes XI and XII in higher secondary schools, join the vocational training institutes or enter the job market. After completing class XII, graduates either continue their studies at the tertiary level under one of the institutes for diploma or bachelor’s degree, or enter the job market (SYB 2016).

Additional efforts have been made in recent years to provide education to all children. A shift has happened from a more decentralized schooling system with a high number of small schools distributed among the country, towards a centralization of school institutions with an aim to bundle available resources (rep (Gesarling school), Informal interview, 20.07.2015). From 2015 academic year on, 24 pilot central schools make the beginning of this new concept with a number of students between 400–1000 and classes ranging from PP (pre-primary) to class 10 or class 12 (MOE, 2014). Table 15 shows educational institutions and actual numbers of students in Bhutan with a share of 8 % of students that are already in Central Schools.

<table>
<thead>
<tr>
<th>School / Institutes / Centers</th>
<th>Government</th>
<th>Private</th>
<th>Total</th>
<th>Students government</th>
<th>Students private</th>
<th>Students total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS (PP - VI)</td>
<td>318</td>
<td>14</td>
<td>332</td>
<td>43120</td>
<td>2594</td>
<td>45,714</td>
</tr>
<tr>
<td>LSS (VII-VIII)</td>
<td>77</td>
<td>1</td>
<td>78</td>
<td>38467</td>
<td>26</td>
<td>38,439</td>
</tr>
<tr>
<td>MSS (IX-X)</td>
<td>69</td>
<td>2</td>
<td>71</td>
<td>44606</td>
<td>1243</td>
<td>45,849</td>
</tr>
<tr>
<td>HSS (class XI - XII)</td>
<td>40</td>
<td>18</td>
<td>58</td>
<td>30746</td>
<td>8288</td>
<td>39,034</td>
</tr>
<tr>
<td>Extended classroom</td>
<td>96</td>
<td>-</td>
<td>96</td>
<td>2312</td>
<td>-</td>
<td>2312</td>
</tr>
<tr>
<td>Central Schools</td>
<td>24</td>
<td>-</td>
<td>24</td>
<td>14998</td>
<td>-</td>
<td>14,998</td>
</tr>
</tbody>
</table>

Table 15: Educational institutions in Bhutan by number of students (PS: Primary School; LSS: Lower Secondary School; MSS: Middle Secondary School; HSS: Higher Secondary School) (adapted from SYB 2016: 52f)

One of these pilot schools is situated in Gesarling Chiwog, which is part of the same administrative unit and is located 17 kilometers from Tashithang. The particular area of the central school is huge and surrounded by evergreen forest, which gives it the appearance of a very remote place. The buildings, mainly built of stone and concrete are distributed over the campus. There are buildings that serve as hostels for the boarding-students separated in boys and girls buildings, a school administration, a dining hall, toilet and washing facilities, as well as structures that contain classrooms for 10 different grades.

Figure 25: Children of class PP in front of a building with washing facilities at Gesarling Central School (Source: own picture, 20.07.2015)
Athletic grounds for modern sports such as football, basketball or volleyball take another large part of the extensive school area (own observation: 06.09.2015). Central schools show another relevant aspect in relation to schooling and land-use and give additional incentives for families to send their children at school.

School fees, materials, clothes and further necessities had to be purchased by families before, whereas a major part of this financial burden is taken over by the newly established institutions. Children shall be provided with everything they need. Apart from boarding facilities that allow for a permanent residence at the school compound, students are provided with free food, school uniforms, special caretakers for the youngest students, books, etc. In short words, students are provided with nearly everything they need for attending school that had to be expensed by parents before. This situation gives further incentives also to families of poor financial background to send their children to school (E2, Informal Interview, 20.07.2015).

"That’s why I always thank to my government for providing hostel (laughing). So easy for parents and villager. To have hostel and government gives that to us, so good – free education" (F3, Personal Interview, 06.10.2015).

Coming from a poor background, F3 highlights the benefits that this new system gives especially for poor people. Only for students, she claimed, it is hard to be in boarding school, but for parents it is good. They have fewer time and financial constraints as they neither have to wash clothes nor prepare packed lunch for the children, which would otherwise 'eat up' the rice stock in the household (F3, Personal Interview, 06.10.2015).

Also at the farm household of the village head where currently three out of four children are staying at Gesarling Central School, the wife seemed to be very happy with the situation that all necessities are provided by their government and no word of resentment was given about the permanent absence of their children during the schooling year. She mentioned that she would visit her children regularly (SW, Informal Interview, 30.07.2015). On Saturdays and Sundays parents can visit their children in Central Schools, which has to be done at least once a month. According to F3, teachers have made these rules because they also grew up in hostels without seeing their parents at all (F3, Personal Interview, 06.10.2015).

The broad support of resources, such as food, lodging, school materials, etc. provided by the RGoB, establishing these new institutions, seems to be an additional incentive for families to send children to school with the aim to ensure a high-quality education for a good life for them. I argue that this policy strategy, with an aim of maximum school enrollment, has far-reaching implications for land-use and livelihoods strategies that I want to examine in more detail.

The first aspect in this relation is the predominant absence of young people during the agricultural year that can be classified as a form of out-migration. Only few household members in Tashithang stay permanently on the farms during the year to conduct daily farming activities. Children from 6 years onwards stay usually off the farm to pursue education or training outside of the villages, often making use of boarding facilities in schools. During the time of education and training, farm households consequently cannot count on the labour force of the young generation. Instead, students only return home during their holidays, maximum for 2 weeks in summer and 2 months in winter season. F7, an elderly couple, claim in this direction that most of their children are in school and would only return home during the winter season when there is no work in the fields. Instead it would be better for them, if school vacation would be in summer season to compensate the labour shortage that they face in times of working peaks (F7, Personal Interview, 13.09.2015). Even though the number of family members has decreased strongly in the region, the young generation might still represent half of the family members (assuming only 2 children per family). If this workforce is not available on the farms, it means that remaining household members need to find alternative labour-saving strategies.

Apart from the lack of workforce that is associated with this form of permanent absence, another aspect is related to changing patterns of knowledge transmission from the elder to the younger generation for a
particular farmstead and related ecological conditions that goes along with increasing school enrolment. During the time of paddy transplantation in July 2015 I met a young woman on a farm who told us that she came back to the village only recently. When we asked her why she would not be at the fields with many other villagers who worked at this day together on the labour demanding task of paddy transplantation she argued that she would not be able to do this work as she only stayed at school and in other households and has never learned to do this. Additionally to that, she would get backache from bending up and down to plant the paddy seedlings and asserted that she would probably leave the village again due to these reasons (Village tour (Pungtsi), Informal interview, 04.07.2015).

Although agriculture is an important subject in schools that is repeatedly taught in different subjects and can be even chosen as a particular scientific branch from class 10 to class 12 (F3, Personal Interview, 06.10.2015), I argue that there is a qualitative gap between practical working and learning on a farm stand with certain ecological conditions and requirements on the one hand and a mainly theoretical learning about farming in a school context on the other hand. Practical work on the fields, together with relatedness to village life I argue, might be an important aspect to guarantee a transmission of practical capacity and knowledge in order to continue physical and psychological demanding farm work also in future terms without the need of labour substitution by labour saving strategies (see 5.3.2).

Finally, parents also need to support their children financially during education, which is a further driver to engage in cash crop production or off-farm employment. Even though the new system of Central Schools has been established recently and provides most of the resources necessary, there are still many governmental schools, until grade 12 (see Table 15), that demand for investments in books, school fees, food, etc. According to a village representative of Dogak village, there are three groups of people who stay off the farm. First, people who left the village and work outside, which may sometimes contribute money to the farm. Second, young people who are in education and have to be supported financially in most cases, as well as group 3 who are pursuing different kinds of vocational trainings. The farms, he argued have to sustain generally by themselves and need additional financial resources to support siblings who stay out from the farm (Village tour (Dogak), Personal interview, 10.07.2015). Farm households most probably relate education of children to a need for financial resources. These resources have to be generated either by selling of agricultural produce or by finding (off-farm) employments, which increases the pressure to generate cash income.

F3 argues that everybody would engage in school nowadays. At her time it was still difficult to do so but it would be easy nowadays to get to school as many schools compete for children. Due to that, there are no more children left who stay back in the village (F3, Personal Interview, 06.10.2015).

5) Searching for opportunities

“If these jobs are not forthcoming, how will their confusion, if not resentment, be addressed? How is the educational system inadvertently contributing to the emptying out of the rural areas, not only because schooling is perceived as better in the towns but because the work that has to be done in the countryside is viewed as unimportant and degrading? What is the trade-off between losing the labour and control of your child to the distant and unknown institution of school?” (Gordon, 2013: 13).

Young, educated people seem to choose rural-out migration as their preferred livelihoods-strategy to search for jobs outside of the primary sector, instead of staying back to continue the work of their parents on the farm. This issue of rural-urban migration was repeatedly mentioned as one of the most challenging, not only in the village, but in the country itself (Dosch, 2011). As these young people were consequently not present in the field site during this study, they cannot serve as a reference to find reasons for their decisions. Instead, I want to refer in this case to sources from village representatives and farmers. The succession of farmsteads, I would argue, depends to a great part on the willingness and capacity of, at least one, of the children to continue the work of the elder generation. According to interview partners, young educated people tend to leave the village after
their studies to search for jobs mostly in urban centers and look for an 'easy way' (rep (Kana Geog), Personal Interview, 06.07.2015). The lack of young people, who have the ability and will to do demanding, manual work, raises questions of future pathways on a village-, and country-level, which still depends to large extent on manual labour in agriculture.

"There is a vast difference compared with past times. The new generation is leaving the village now. Before, people were not educated, but now they are highly educated and therefore are not interested in village life anymore" (rep (Middle Goshi), Personal Interview, 08.07.2015).

From the perspective of the village head F10, those people left the village due to a lack of development activities. Now, as there are some facilities available, few of them are coming back. If all the facilities that are available in cities would be also available in the village, he believes that this would give an incentive for them to come back. If all those emigrants who left the village to search for work would return back, the problem of labour shortage in the Chiwog would be solved he argued (F10, Personal Interview, 12.07.2015).

RNR extension officers from the region gave another perspective on the dilemma of rural-out migration of the youth. From their perspective, it would be necessary to provide jobs in the region, such as by establishing cottage industries. If there are no jobs in the region the youth would not come back. E3 even argues that it would be not only about jobs but that young people would also search for freedom from their parents but jobs would be an appealing option for young people anyways and some of them would get attracted and come to the village, whether they have lived in the region before or not (E2,E3; Personal Interview, 11.07.2015).

F1, an elderly couple in the village highlights shortage of labour as one of their main challenges to continue their livelihoods. Their children are all outside of the village and focus on their jobs.

"Nowadays he has really challenges, big challenges because of lack of like labours, so shortage of labours. And just now they are just living only the two. All the rest of their children and daughters are not here so that is why he has big challenges now. It is kind of difficult " (F1, Personal Interview, 14.09.2015, translated)

Their children have already jobs in other parts of the country and are currently not planning or willing to come back to the farm:

"Translator: Now, are your children sometimes coming back to your house? Do your children have plans to stay with you? Are they telling like that?
F1: Now, they don’t say like that because they are focusing on their own jobs. They enjoy their jobs. Earning, eating and just sitting [...]" (F1, Personal Interview, 14.09.2015, translated).

This raises questions about the future of farms and the continuation of farming as a livelihoods strategy. According to F1 the children need to come back one day or the other to care for their old parents.

"But in the future they have to come, right? If they are not coming back, where should we go? Here is our land. I have to share this land to all family members. I have to give to all of them. Ok, you just take this, and you just take that - in this sense I have to divide it between them. Otherwise if it is not like that they will fight between each other in the future” (F1, Personal Interview, 14.09.2015, translated).

6) "To stay in village is also hard"

Finally, a smaller share of youngsters stays in the village to work on the farms of their parents. This can be framed as remigration to the village that is also linked to a lack of alternative opportunities and financial resources to continue a career within the schooling system. In Tashithang village 7-8 young adults, who have completed class 10 or have dropped out of the schooling system before, live permanently in the village and follow agriculture as a livelihoods strategy. According to F3, all of them who have returned to the village willingly
or unwillingly would do well in this field (F3, Personal Interview, 06.10.2015). However, after a long absence from practical agricultural work, those returnees face difficulties to readapt practically in the agricultural field:

“ [...] If you go on my field you see, there is no much more agriculture things, just now I am just new to agriculture. Though I was brought up with agriculture, practically I am new to them. Thoroughly I have an idea, but practically I am new to them. In small area, but I am focus on good quality” (F3, Personal Interview, 06.10.2015).

F3 highlights her actual lack of knowledge and capabilities in the agricultural field due to long-time absence from this field. Another youngster exemplified a resentment of educated young people, who have changing perspectives on material well being compared to the elder generation and need to stay back in the village

Figure 26: Young farmer in Tashithang (own picture: 19.09.2015)

The son of F6, who returned to Tashithang after he completed general education, lives together with his two old parents and an elder brother on their farm. When I met him coincidentally in the grocery shop in Tashithang he was obviously drunk and claimed that he was drinking for three days in a row. Constantly he repeated that he does not have much money, that he is a poor man, and that their house is very small. First he started complaining about their situation of money. He said that he would work hard in the fields, but that the money is not “coming nicely” as he would expect. His family is also increasingly focusing on cardamom at the moment. He complained that he would only have a very old car, while his big wish is to have a “Prado”, a Japanese car that costs around 60.000 Euro in Bhutan. Some of his friends would have such a car and he always feels ashamed with his old-fashioned one. They would always make jokes due to that. He could be a very important person this day if he had continued his studies. But as he was not good enough, he has to stay in the village with his old parents, because nobody else is there to help them. As a child he always wanted to become a Wrestler like "Johnson" and this is still his big dream, to earn 15 legs (= 21000 €) and leave Bhutan to become a professional Wrestler (JG, Informal Interview, 27.07.2015).

The decision to return to the village can be also seen as a lack of alternative opportunities for young adults after completing their general education. This situation shall be explained by the case of F3, who dropped out from school after finishing her general education after class X. Students have to sit a final exam after the end of class X (after 11 years) in which their performance decides upon the possibility to continue their career in a government higher secondary school in class XI and XII. F3 could not accomplish enough points but was slightly below the entry point. In this case she claimed that students, as in her case, have different options. One way to continue her education in a government institution would be to repeat the exam in the next year and to reach the required score. She claimed that this would be very difficult in her present situation, as she could only learn in the morning hours from 4–7 a.m. and in the evening hours, when all duties on the farm are completed for the day.

Another way to continue her education would be to attend a private college, which is linked to high financial expenditures, which her family cannot afford (F3, Personal Interview, 06.10.2015). F10 declared that this type of higher education in a private college would demand for substantial financial resources. In their case it would cost
around Nu.50000 (= 695 €) per year to send their eldest son to a private college in Gelephu (F10, Informal Interview, 24.07.2015). Due this high price, many families are not able to send their children for further private education if they are not able to reach the required score to continue their studies in a college subsidized by the government.

A third option for young adults is to pursue a vocational training in certain sectors after completing their general education. In the case of F3, she participated, together with a second young man from the village, in a study tour to visit different parts of the country. This voyage had the aim to familiarize young people with different projects and concepts in the field of agriculture from fish breeding to group farming in the field of organic agriculture. After her decision to return back, F3 can see also many benefits for her in the field of agriculture. The job market is very crowded she claimed. It would be a permanent rushing and pushing. Instead she wants to show an example in her village and wants to start a project of organic agriculture with a group of friends (F3, Personal Interview, 06.10.2015).

"What is organic farming, because [...] now [...] maximum of Bhutanese are consuming the produce of India, Kashmere, Assam. They all are using pesticides, this what, chemical things. I don’t like such things. After all with a lot of disease with chemicals. Burning lake, burning soil, so I don’t want to see my Bhutanese good guys. Yeah, I am single here but I am all alone to do [...] but I think about my Bhutan, my country, my world” (F3, Personal Interview, 06.10.2015).

Finally, it is important to mention that the option for youngster to return to agriculture is negatively connoted by society and is often seen as a failure of the respective career, according to a young government employee from Thimphu. Parents would implicitly expect from their children to find a more lucrative livelihood outside of the agricultural field (MN, Informal Interview, 25.08.2016). This point was also raised by F3 when she points out that villagers would label her as "useless" and "doing nothing" because she has returned back to work in the agricultural field.

"I think they are not happy, because parents always want to make their children happy. See their child happy, because sometimes I used to get angry, no? (laughing) Why don’t you study? Then they hear, then they feel sad. Because they feel sorry, because they did not afford me. But helping here and there and most of the people talk about me. See this girl she is not doing anything" (F3, Personal Interview, 06.10.2015).

Institutionalized education has emerged as an important topic related to agricultural land-use during the research process. The increasing importance on a centralized education system in Bhutan can be seen as an additional step to educate young people rather for a modern wage-based market economy than on the continuation of traditional farming practices that would require inter-generational on-farm learning to ensure a substantial number of people working in the primary sector.

**Summary: Nobody at home - Migration for a better life**

Labour shortage is an important issue in Tashithang related to land-use and rural livelihoods. Current farm households have to deal with a situation of low availability of on-farm labour force and concurrent increase of labour costs. Major drivers for this situation seem to be policy strategies that aim to lower population growth rate by family planning campaigns on the one hand and different forms of historical and actual migration trends on the other hand. Especially the role of education with an aim to maximize school enrollment seems to play an essential role for the question of subsequent rural-out migration and emptying out of the rural area.

A political conflict and concurrent out-migration at the beginning 1990s has had profound implications for demographical patterns when only 20–25 households remained from totally 80-90 households before 1990s. A
subsequent process of resettlement from people of different parts of the country has happened from 2002 onwards and has provoked a process of mutual adaptation in Tashithang.

The remigration of people to the village due to appealing economic opportunities by growing cash-crops such as cardamom was seen as another type of in-migration to the village that appears to change the focus from an integrated farming system towards a commodification pathway with a focus on a single-crop strategy and less consideration for ecological conditions.

The main focus of this chapter was laid on different forms of migration that are linked to education and training by children and young adults and implications of these strategies. Permanent absence of children and young adults appears to lower the number of permanent household members and demands for alternative ways to manage the farm labour. Additionally I argued, that this goes hand in hand with a lack of knowledge transmission from the elder to the younger generation and that institutionalized education in schools seems to be implicitly prioritized by policy strategies in favor of a learning process that can be rather labeled as on-farm and inter-generational and might be needed to get ready for physical demanding, place-based agricultural work.

A current process of centralizing the education system with the aim to bundle resources and maximize the school enrollment of children raises questions of an increasing emptying out of rural areas, driven by an education system that gives students mainly theoretical knowledge in different fields that may qualify them to search for job opportunities mostly outside the agricultural field. This may be a reason why a majority of young educated adults don’t come back to the village but search for alternative job opportunities mostly in urban centers of the country. Farmers and village representatives raised different perspectives according to this situation. One point was raised related to a lack of development activities in the villages in contrast to urban centers. If modern facilities would be also available in rural areas this could motivate young people to return. Another reason was the current lack of job opportunities in the region. Apart from agricultural activities there are only few jobs available that could attract youngsters to come to the region. The establishment of cottage industries was mentioned as a possible solution in that way. A smaller share of young adults have returned to the village after finishing their educational career or dropped out before. 7–8 young adults are currently living and working in Tashithang village to work in the agricultural field. The situation of returnees seems to be also associated with a lack of alternative opportunities for them. If students fail to reach the required score in their final exam after class 10, it may lead to the situation that they choose to return back to their home villages. The continuation of their educational career would demand for a repeating of the exam in the next year, high financial expenditures for a private college, to pursue vocational training or enter the job market. Re-migrating to the village maybe a “final” option for them, which connotes a confession of failure in their educational career to find more comfortable and lucrative livelihoods.

### 5.3.2 Land-use strategies to cope with labour shortage

"He is saying it is all because of development. Now the country is developing and in the same way as there are no more people in the village, the government is developing, providing new machineries. He is saying, the country is developing and now many things from paddy transplanter, to harvester is available. We have to look at Japan, China. He believes that the government will provide the machines to them. If the government does not provide also, other villages have the same problem and they won’t work manually." (F8, Personal Interview, 01.10.2015, LS interpreter)

The situation of labour shortage that is mainly driven by rural-out migration of young educated people, who stay outside of the village during their education and won’t return back to the village in many cases, raises the question of alternative forms to manage farm work, even with a low number of permanently available household members. Apart from different forms of labour allocation, including household labour, service exchange and hired labour, this situation is also related to labour saving strategies. Mechanization and the use of
farm inputs, such as pesticides and chemical fertilizer seem to provide possible technological solutions to deal with the constant labour issue but beg the question for a compatibility with sustainability goals and a current vision of organic agriculture in Bhutan. Increasing utilization of pesticides and external energy carriers (see 4.4.1.1), needed for chemical fertilizers and operation of machinery, might be seen as a threat for an organic vision in agriculture and a broader pathway of sustainable development based on alternative energy scenarios.

Organization of farm labour

The allocation of labour on the farms is generally organized by the farm households in a way as it was described by (Netting, 1993). The farm household has its role as an organizational unit that allocates labour according to its needs. The households follow different strategies in order to realize all farm activities, even if there is not enough capacity among its members. Farm household organize labour allocation by using available household labour, a system of mutual labour exchange, and the payment of hired labour.

In case of cardamom, tasks are mostly seasonally and can be even shared among friends and neighbours in times of working peaks:

"And then, if we plant cardamom - comparing the price nowadays it gives a high profit. There is also little work that has to be done. And then, if there is so much work, how is a couple able to do? Right? And then, if we have only the cardamom, we can ask friends and brothers to do the work" (F1, Personal Interview, 14.09.2015).

A system of service exchange is one strategy that is practiced in the village to complement household labour. This system of mutual labour exchange helps the farm households to allocate a sufficient number of people to fulfil labour demanding tasks during times of working peaks without spending money. Friends and neighbours work together at different labour demanding occasions, such as for paddy transplantation or weeding of cardamom.

"Because, if you don’t have money, no? Today two, three days I will go to other’s work, after the time they will help me. If I help him one day, no? He will help me one day. [...] If we don’t have money, we do like this. If I have money, I will pay" (F2, Personal Interview, 11.09.2015).

But the system of service exchange also has its limitations. Referring to F5 it is difficult to find workers during the season in these days due to a general shortage of labour:

"Like that is difficult to get every day. During the season I have work here. My neighbours also have work, other’s also have work, other neighbour also have work. So at that time at the big time it is difficult to get workers. [...] During the off season – you get workers (F5, Personal Interview, 16.09.2015).

The general lack of labour in the village is the major reason why farm households depend also on the allocation of labour by payment of hired workers, additionally to household labour and the system of service exchange. Hiring workers is not only done for cardamom cultivation but also for cereal crops such as for the labour demanding plantation of paddy seedlings. Hired workers either come from the village itself but in times of high labour-demand, such as in the season of cardamom harvest, workers come from different places outside of the village such as for the labour demanding task of cardamom harvest when workers from outside arrive in groups to find wage labour in this sector.

The village head of Dogak gives an example for the trade-off between different cultivation practices depending on the number of available workforce on the farm. He claimed that the cultivation of Paddy depends in their case on the availability of workers. If students come back during the summer vacation and if sufficient workers are available, they will plant paddy, otherwise they will only cultivate cardamom, because the seasonal task of
weeding can be done even by few people staying at home (rep (Dogak), Personal Interview, 10.07.2015, translated).

The labour demand in cardamom cultivation is mainly a seasonal task. Replantation, weeding, harvesting, peeling and drying are the main tasks that need to be done until the valuable seed pods can get stored in big sacks of jute and wait for buyers. An extension officer claimed that the price for labour increased from Nu.40–50 (= 0.55–0.70 € cent) per day in 2003 to Nu.400–500 (= 5.5–7 €) in 2015, which is not easily affordable for everybody. The money needed for the cultivation of cardamom may come either from proper money savings (e.g. last-years cardamom harvest, selling of animals, etc.) or may be provided by money lenders who make a contract with farmers to sell their cardamom produce at a certain rate.

Financial assets that is necessary to pay hired labourers become more important in the village in times of high labour costs. This is illustrated by a young farmer who returned to the village after studying abroad and has invested in cardamom business to generate cash income. He invested Nu. 150.000 (= 2085 €) to pay hired workers for the harvest of his 35.000 plants and Nu.200.000–300.000 (= 2800–4200 €) for the hired workers that are needed for the whole year according to his estimations. 2015 was the second year that the young entrepreneur could harvest fruits from his 3.7 hectares that are fully planted with cardamom. He hired 13 to 14 workers who lived continuously at the farm during the harvest season. Workers, he claimed, often come in groups to the cardamom growing areas from different regions and search for work during the harvest season.

Figure 27: Collected cardamom, dried over 'Bhatti' (own picture: 04.10.2015)

Manually, by using simple tools, the fruits must be cut off from the stem-base of the plant, peeled and dried over the 'Bhatti', a traditional stone-built stove that is used for the fast drying of cardamom over open fire fuelled by fresh wood (see Figure 27). The young entrepreneur had to pay Nu.500 (= 7 €) per day and worker, additionally to food and lodging, and estimated that the whole undertaking of harvest would take 30 days. The price for cardamom in 2015 ranged between Nu. 1000-2000 (= 14–28 €) per kg, which was a tenfold increase within the last five years. The young farmer gained 600 kg of marketable seedpods in the second year (2015) according to his calculations. With respect to these numbers the farmer earned Nu.900.000 (= 12500 €) in the year 2015 assuming an average price of Nu.1500 per kg (Personal observations, Informal Interviews, 01.10.2015; 02.10.2015). This example shows the economic dominance of cardamom, and the increasing need of financial assets to allocate labour force accordingly.

Farm households follow three different strategies on an organizational level to cope with the situation of low on-farm availability of workforce. F10 exemplifies the situation of his farm where they need 120 man-days per year additionally to the labour invested by household members only in cardamom production. He estimated that half (60 man-days) of the labour invested was done via labour exchange and half by hiring labour in his particular case (F10, Personal Interview, 10.08.2015).
A drastic increase of labour costs was observed in the village. This trend provokes the necessity of alternative land use strategies to manage the current labour demand. One strategy, as mentioned above, is to organize labour allocation within the community as of the demand (household labour; service exchange; hired labour). Cardamom, and alternative cash-crops with a high economic return offer additional perspectives that allow for a higher investment in hired workers due to high sales-prices and gives farmers with high financial resources opportunities to apply a relatively higher number of workers. Leaving land fallow is a third strategy followed by farmers in this case (E2, Personal Interview, 11.07.2015).

**Labour saving strategies**

Additionally to these strategies, questions about alternative labour saving strategies arise. Farm inputs such as machinery, high-yielding varieties, chemical fertilizers and pesticides are available technological solutions that might raise labour productivity in the village. Farm-mechanization was repeatedly claimed as a possible path in the future to solve the problem of labour shortage by farmers. On the other hand, extension officers claimed, that an introduction of ‘power tillers’ for preparation of fields would only benefit a limited number of 5–10 households in the village, due to the steep terrain of farmlands (E2, Personal Interview, 11.07.2015). Farm inputs, especially different classes of pesticides, are already in use by farmers to protect certain crops or decrease the demand for labour through mineral fertilizer are only used in small amounts.

**Machinery**

Farmers in Tashithang use mainly two simple hand-tools to facilitate their work in the fields. A sickle (see Figure 28) with a slight curve and a ‘Khukkuri’, a big knife-like tool of around 40 cm of length are used for various tasks, such as for harvesting, cutting and preparation of fodder, or in the case of the knife even for construction purposes. An axe is additionally used to cut firewood.

Figure 28: Sickle and vegetables (own picture: 22.07.2015)

Another tool much used by farmers in the region is the “Dokko”, a basket made from bamboo that is mainly used for carrying goods and even for harvesting purposes (see Figure 29).

Figure 29: Dokko - traditional bamboo basket (own picture: 10.09.2015)
Plough and bullocks are another fundamental element of the current land-use practice used for soil preparation in dryland as well as in wetland cultivation (see Figure 30). The bullocks are temporarily kept in cow sheds during working periods. After the task is finished, the animals are again released to the jungle to reduce the need of feeding. One person, traditionally a male member of the household, guides the animals by using a stick and repeated shouting for the guidance of the bullocks. The task demands much strength, especially when it comes to muddy paddy fields that need to be prepared up to 3–4 times before the plantation of seedlings (personal observations). Animal traction can be used even in steep and difficult terrain where the use of machinery is often challenging or even unfeasible according to the agricultural extension officer (E2, Personal Interview, 12.07.2015).

Figure 30: Ploughing the field (own picture: 06.10.2015)

E2 made a calculation for the case of the 'power tiller' comparing it to the traditional form of plough and bullocks. Farmers can rent a power tiller for Nu. 1400, including an operator and fuel needed for 8 hours a day at the geog RNR office. Comparing this to the hiring of bullocks and a 'plough-operator' from other farmers if not available at the farm, this would cost Nu. 750 per day for only 4-5 hours and would take much more time (E2, Informal Interview, 10.08.2015).
Apart from the power tiller, another machinery, a so-called grass cutter (see Figure 31) has become popular among farmers for cardamom weeding. According to E2, people who have a little bit of money would now start to process this machine as they would look for alternative ways to compensate the labour shortage (E2, Personal interview, 15.09.2015). Economically spoken it seems to be an attractive option for farmers to either purchase a grass cutter by themselves or, to order an "all-in-one package" offered by grass cutter-operators that can be hired per day including machinery. Hiring this machine, together with an operator and the petrol needed for one day, meaning 8 hours of work costs the farmers Nu.700 (= 9.7 €). The machine needs about 2l of petrol per day and 1 person could clear 0.405 ha (1 ac.) of a cardamom field, if it is a nice plain area, in 1 day. When the farmers would pay workers to pursue the same activity, E2 estimates that they would need 10 man-days to finish.

Figure 31: Grasscutter to increase labour productivity (own picture: 27.07.2015)

He calculates the price for one worker for such a task with Nu.300 (= 4.2 €) per day additionally to serve them food and drinks. Which costs Nu.3000 (= 42 €) for the workers without food. Until now most farmers would not be aware of this tool, but from his perspective it could help them a lot (E2, Informal Interview, 10.08.2015). Alternative voices were raised concerning the feasibility of the grass cutter. The wife of F10 argued that it would only work if the grass were still low. In case of high grass it would not work (SW, Informal Interview, 13.09.2015). F1 argued in a farseeing and careful way that the machinery has to be tested first before he could decide about its feasibility:

Translator: Maybe you are planning to buy a machine? Nowadays everywhere it is available.

F1: The machine is just arriving, right? First we have to see and try it out. [...] If the machine is working perfectly, we have to see the benefits also (from the machine). Right? In the machine it is also needed to put fuel as well as to put an operator. The people are also needed, right? Again comparing to the workers, if that machine does not work more than the people, then it is not profitable. We have to see our profit. Right? (F1, Personal interview, 16.09.2015, translated)

Mechanization is definitely seen as a major solution for the problem of labour shortage in rural areas both by governmental institutions as well as from farmers and village representatives. Grass cutters and power tillers represent main candidates to change the land-use system by substituting manual or animal labour with the utilization of machinery.

**Pesticides and chemical fertilizers**

A form of green revolution has reached Bhutan during the 1980s with a technological package consisting of chemical fertilizers, pesticides and high-yielding varieties of cereal crops as outlined in chapter 4.4.1. E2 claimed that the village as such puts a focus on organic production and a small group of farmers were trained in organic land-use practices.

However, different types of pesticides are currently in use by farmers. ‘Butachlor’ is one example that is widely used in paddy cultivation as herbicide and is applied after paddy transplantation to reduce the labour demand of
weeding. Even though the country is focusing on organic agriculture, farmers get the possibility to order different pesticides at the regional RNR office but have to pay a full market price without subsidies from the government (E2, Personal Interview, 15.09.2015). Previously, around 15 years back, E2 claimed that pesticides have been supplied free of cost to the farmers and were used in much higher amount than today (ibid). Apart from ‘Butachlor’ for paddy cultivation that is used by farmers on a regular basis, a farmer claimed that some people in Tashithang would use herbicides also in cardamom production to get rid of the extensive weed and to reduce labour demand. The policy strategy of the government would be an organic vision and they would promote this strategy among farmers and give advices not to use synthetic pesticides. However, farmers would still use these substances that often come to Bhutan via India (JB, Informal Interview, 04.08.2015). These herbicides, such as glyphosate that was mentioned repeatedly, were not provided from the RNR office to farmers but were purchased from alternative channels as E2 claims (E2, Personal Interview, 15.09.2015). To protect plants from pests and insects further phytosanitary measurements, such as sulfur dust, are applied for example on citrus orchards that are currently endangered mainly by citrus greening (E2, Personal interview, 15.09.2015). Different insects in cardamom production are another threat for plant health and F1 declared that he used some medicine from his daughter to treat his plants in 2014:

"Now, during some time insects eat everything of the leaves of alainchi and will only leave the leaf-nerves behind. After they did that, there is a kind of powder that is used for treating the plants, which got affected by the insects. We have to spray this medicine together with water with the machine. Last year I did like that because the plants got strongly affected by the insects" (F1, Personal Interview, 16.09.2015)

Mineral fertilizers seem to be no big issue in Tashithang, referring to E2. Farmers would be not willing to apply mineral fertilizers, as they are aware of negative impacts of these substances that would stimulate soil compaction and soil erosion. Instead they would mainly use manure to fertilize their fields. In a context of a decreasing number of animals presently on the farms as outlined in chapter 5.2.2 and utilization of high-yield varieties of maize, vegetables, etc. this raises questions of nutrient availability, especially if targets were set by the government to increase agricultural production (E2, Personal Interview, 15.09.2015).

High-yielding varieties
E2 estimates that 50 % of cereal crops cultivated in Tashithang are currently hybrid-varieties. Farmers would not depend fully on high-yield varieties, as they do not trust entirely on the yields. Extension officers offer farmers to order high-yielding seeds with a cost-sharing program of 50 % from the government by demand. They would advise them to grow high-yielding varieties in order to generate income and local varieties for self-consumption (E2, Personal Interview, 15.09.2015). Farmers currently cultivate one hybrid maize variety mainly for selling purposes because they don’t like its taste for self-consumption in comparison to local varieties. Many farmers rejected an improved variety of maize in 2015 due to poor adaptation to local ecological conditions concerning heavy rainfalls. In 2015 a major part of the fruits of this variety got destroyed when rain entered undermost the outer leaves and stimulated a rot of the fruits (personal observations, 15.09.2015).

Figure 32: On-farm preparation of radish seeds (own picture: 20.07.2015)

High-yielding seeds are normally not replanted every year but taken from the last years’ fruits. In this sense, high-yielding properties of these varieties are decreasing over the years. Only the first year gives a high-yield whereas the yield decreases strongly due to cross-pollination. Farmers ordered seeds via the local RNR office
only in lesser extent in 2015. There was a total order of 100 kg of wheat, 45 kg of maize and 550 apple seedlings from farmers in Tashithang in 2015 (F10, Informal Interview, 15.09.2015).

Apple seedlings have to be paid fully by farmers whereas costs for cereal crops are shared 50% between farmers and government. Vegetable seeds are additionally provided free of costs by the extension officers (F10, Informal Interview, 15.09.2015). Farm households also collect and prepare seeds on an individual basis. At the farm of F10 the grandmother was in charge for the collection and preparation of seeds such as beans, radish, among others. A surplus was sold locally and on the Sunday market in Dagapela (Personal observations, 30.07.2015).

### Summary: Labour saving strategies

Different forms of labour savings strategies are currently practiced in the village. This involves different strategies of using farm inputs in agriculture. Mechanization of agriculture by providing equipment to farmers was repeatedly discussed among representatives and extension officers as a possible solution to solve the challenging issue of labour shortage. Power tillers and grass cutters are candidates that might be used to increase labour productivity. Power tillers, small machineries that can be used like a tractor for small-scale agriculture are presently available at regional RNR offices to be tested in the field. Farmers can rent these machines including an operator and fuel to substitute the traditional equipment of plough and bullock. According to E2 this machinery has only limited relevance in Tashithang as it would only benefit 5-10 farmers due to the steep and rough terrain in the village. A grasscutter for weeding purposes is already in use by a number of farmers to increase labour productivity in cardamom weeding. The machine, even if it were rented, would be an attractive option for farmers to decrease the labour demand for this activity. However, it was claimed that grasscutter only work well in the case when the weeds are still low. Mineral fertilizers are not a big issue in Tashithang and are only used in small extent by farmers. In contrast, different types of pesticides are used on a regular basis. First of all Butachlor, a herbicide used to decrease the demand for weeding in paddy cultivation. Apart from that some farmers have also used herbicides, such as glyphosate, in cardamom clearing in 2015 to decrease the labour demand. Different types of chemical and bio-pesticides can be ordered at the regional RNR office but must be purchased at full price in contrast to the past. 15 years back, these substances were delivered free of cost to farmers and were used in a much higher amount. High-yielding varieties and local varieties in cereal production currently account for 50% of cereals grown by farmers. In that way, farmers are not fully dependent either on local or high-yielding varieties and can spread the risk of failures. Local varieties are mostly cultivated for self-consumption whereas high-yielding varieties are grown mainly for selling purposes. The utilization of improved seeds goes along with questions of soil fertility and nutrient sufficiency that are linked to a decreasing number of cattle and associated reduction of organic manure. The minor use of mineral fertilizer in this context puts a question mark on the continuation of sustainable farming practices and concurrent increase in agricultural production. Preparation and processing of seeds is still practiced on a farm household level and seeds are even sold locally or at the weekly Sunday market in Dagapela town. A change in the farming systems that still depends mainly on human-, and animal labour force towards a system with increasing dependence on fossil-fuel driven technology of external farm inputs, such as machinery, mineral fertilizer and pesticides in order to increase the labour productivity raises questions of future pathways for organic farming and sustainability in terms of energy efficiency.
6 Discussion

In this chapter I will discuss major findings of this study on a more general level with respect to relevant perspectives from literature in the field. First (6.1), I refer my empirical findings to 6 broad sectorial cause categories of land-use change, that were suggested by Lambin et al. (2003). After that (6.2), I look at these insights through the lens of socio-ecological transitions as outlined in chapter 2.1 in order to discuss my findings from a macro-level perspective.

6.1 Land Use-Change

"Land use is defined by the purposes for which humans exploit the land cover. There is high variability in time and space in biophysical environments, socio-economic activities, and cultural contexts that are associated with land-use change. Identifying the causes of land-use change requires an understanding of how people make land-use decisions and how various factors interact in specific contexts to influence decision making on land use. Decision making is influenced by factors at the local, regional, or global scale" (Lambin et al., 2003).

Multiple causes for land-use change, based on farmers’ decisions and external drivers, found in the project site, will be discussed regarding the framework suggested by Lambin et al. (2003). This framework was developed on the basis of findings from various local case studies on land-use change. However, due to limited time resources for the empirical fieldwork on the one and the extensive amount of factors influencing land-use change on the other hand, I focus on causes that are represented in the findings of the here presented study. Figure 33 is an illustration of sectoral causes that influence land-use change. Human and natural causes, representing two interrelated spheres, both influence land-use change. (I) Natural causes include phenomena that are based on biophysical variability. The sphere of human causes includes: (II) economy and technology, (III) demography, (IV) institutions and (V) cultural factors, which are also interrelated among each other. All causes of land-use change are furthermore amplified and attenuated by underlying processes of (VI) globalization.

Figure 33: Sectoral causes influencing land-use change; own illustration based on Lambin et al. (2003)
**Natural variability** is a cause that interacts with human causes and influences land-use change (Lambin et al., 2003). Pointing on the here presented findings, biophysical variability plays an important role for land use change in Tashithang. Place-based ecological conditions such as north-sided exposition and favourable soil conditions among others were claimed to be beneficial for cardamom production (see 5.2.3.2). The drying of water sources, needed for irrigation of paddy, cardamom and vegetable production, is a severe issue in Tashithang and was related to changing rainfall patterns, what may be a consequence of climatic change (see 5.2.3.3). Further issues of natural variability are related to increasing risks of pests and diseases, especially for valuable cash-crop production of cardamom and citrus (see 5.2.3.3), as well as human-wildlife conflicts resulting from and contributing to a change in cultivation patterns in order to reduce crop losses (see 5.2.3.2).

**Economic and technological factors** are seen as most important with regards to land-use change at the timescale of a couple of decades or less. Lambin et al. (2003: 218) argue that "land-use changes mostly result from individual and social responses to changing economic conditions, which are mediated by institutional factors. Opportunities and constraints for new land uses are created by markets and policies and are increasingly influenced by global factors".

Economic opportunities and technological changes are undoubtedly major drivers for current land-use decisions made by farmers in Tashithang. Farmers increasingly focus on crops to generate cash-income. Cardamom and mandarin, and more recently also hazelnut, kiwi and apples offer appealing economic opportunities both to sell on national as well as on international markets, and appear as strong incentives to change cultivation patterns.

More generally spoken there is a shift happening in the local economic structure from subsistence-oriented agriculture towards an increasing integration into a (global) market economy as outlined in 5.2.2 and 5.2.4. This process is driven by a variety of factors that are often interlinked and influence each other in that way. Important factors that drive this development are:

**Necessity to earn cash-income**: Farmers take decisions of land-use increasingly according to their market participation. Changing societal conditions such as lack of labour force resulting from rural-out migration, education fees, investment in agricultural equipment, vehicles etc. (see 5.2.3.2) require a constant flow of cash-income related to production of high-value crops. This commodification pathway of agricultural produce gets facilitated by the existence of transport infrastructure such as highways and (farm) roads (see chapter 5.2.1) that strongly reduce transportation costs for farmers and open up new market opportunities, while simultaneously putting pressure on locally produced low-value staple crops. Electricity and availability of affordable energy are seen as another factor that modifies a range of habits, such as communication, information and cooking patterns. New technologies, such as cooking facilities, emerge in this process and increase the demand for investment of money and energy. Commodification also raises questions of unequal distribution of wealth among farmers that allows or limits opportunities of more efficient land management driven by capital (see 5.2.3.3). The use of machinery such as power tillers and grass cutters are particularly important in the context of agricultural intensification and are currently discussed and tested by farmers. Mechanization is seen as a viable solution for current challenges of labour shortage to increase labour productivity by farmers (see 5.3.2.1). Chemical- and biologically-based pesticides are currently in use in Tashithang; both to protect crops from pests and diseases and to reduce labour demand (see 5.2.3.2). This development demands for financial resources from farmers and is another driver that intensifies a shift from subsistence oriented farming towards an increasing market participation of farm households.

"Markets trigger commercial intensification of agriculture in a commodification pathway. Investments in crops or livestock modify the factors and value of production per hectare. Economic differentiation, wage labour, contract farming and other adjustments follow. This pathway is linked to external sources of demand and its sustainability is tied to the vagaries of the market. Collapses in product markets and/or subsidy programs supporting these markets trigger collapses or changes in production systems” (Lambin et al., 2001, 265).
The commodification pathway outlined by the authors shows similarities to my examined case and also highlights the (economic) risks associated to this strategy (see 5.2.3.3).

Demographical factors

"At longer timescales, both increases and decreases of a given population also have a large impact on land use. Demographic change does not only imply the shift from high to low rates of fertility and mortality (as suggested by the demographic transition), but it is also associated with the development of households and features of their life cycle. The family or life-cycle features relate mainly to labour availability at the level of households, which is linked to migration, urbanization, and the breakdown of extended families into several nuclear families" (Lambin et al., 2003: 218).

The village is in a transition process in terms of demographical patterns that changed from traditional patterns that included extended family households that work predominantly in agriculture towards a new demographical structure with less household members working on the farm. Young household members increasingly leave the farm to follow diversified livelihoods strategies with implications for land-use in terms of labour force and knowledge transfer. In chapter 5.3.1.1 I pointed on implications of historical and actual in- and out-migration movements for current demographical patterns, of which rural-urban migration seems to be the most far-reaching related to labour shortage. Migration was also mentioned as a highly important factor influencing land-use change in the coming decades by Lambin et al. (2003). Another important aspect that came up is linked to policy campaigns that promoted family planning, which seemed to contribute to a breakdown of extended families and reduced workforce on farms. Education in general, and a policy aim of centralization and maximum school enrolment in particular, were identified as a major driver for these far-reaching trends (see 5.3.2.2).

Institutional factors on a political, legal, traditional and economic level are known to interact with individual decision-making concerning land use (Lambin et al., 2003). Concerning institutional factors Lambin et al. (2003: 220) argue that "the impact of institutional drivers moves from the local to the global level" due to increasingly interconnected market forces and the rise of international environmental agreements.

Governmental institutions representing political, legal and economic institutions interact in a broad way with individual land use decisions made by farmers in Tashithang. Provision of infrastructure in terms of transport and energy (electricity), which has far-reaching implications for economic opportunities and thus land-use change, is one example (see 5.2.1). Another aspect is the granting of subsidies via cost-sharing programs for cereal crops as well as for the provision of cardamom seedlings from governmental as well as non-governmental institutions (see 5.2.3.1). RNR offices moreover offer the possibility to order or rent farm inputs like power tillers or pesticides (see 5.2.4). In that way, governmental institutions in Bhutan follow a multi-dimensional approach to facilitate agricultural production by increasing labour and land productivity on the one hand and promote commercialization and market integration of agricultural produce on the other. Governmental institutions also influence individual decision-making by legal regulations and laws such as in the case of policies to ensure food self-sufficiency (see 5.2.3). Irrigated land, formerly used for paddy cultivation, shall not be used for cultivation of perennial crops or construction of buildings, which leads to perceived conflicts for farmers who increasingly focus on cash-crop production even on paddy land. Economic institutions in Tashithang operate on a local as well as on a global scale. The traditional business of cardamom and mandarin trading to the Indian border by middlemen (see 5.2.3.3) is more regional in its dimension and is nowadays complemented by a contract-farming model installed by an international company investing in agribusiness in Bhutan (see 5.2.4). FDF company has control over large parts of the resource and value chain of hazelnut production, provides equipment and plant material for farmers, gives technical assistance, evaluates the progress of production, offers secure international markets and a calculable price.
Cultural factors influence land use decisions via attitudes, values, beliefs and individual perceptions:

“Land-use decisions have intended and unintended consequences on ecosystems; these depend on the knowledge, information, and management skills available to land managers” (Lambin et al., 2003: 220).

Cultivation practices in cardamom production exemplify diverse attitudes and perceptions related to land use management among farmers in the village. The necessity of shading trees for successful cultivation of cardamom and different perception of current pests and diseases illustrate a range of strategies followed by farmers due to individual knowledge and decision-making (see 5.2.3.1). Another aspect in this relation is farmers’ attitude towards risk. In the here presented case, the focus on a monocultural cardamom production was perceived as a risky farming strategy by local extension officers and village representatives in economic and ecological terms, whereas farmers did not perceive their land use strategies as fraught with risk. In case of upcoming pests or diseases, farmers argued to change their cultivation pattern and grow staple crops as before or to build on different economic pillars in order to prevent total crop losses (see 5.2.3.3). Due to historical and actual migration movements, the village of Tashithang has become increasingly heterogeneous in terms of ethnicity and religious beliefs. This diversity also manifests in varying food habits that again result in different land-use practices.

Lambin et al. (2003) claim that Globalization is not seen as driver per se but as underlying process influencing the aforementioned drivers.

“Researchers have recently argued that cross-cutting the local and national pathways of land-use/cover change are the many processes of globalization that amplify or attenuate the driving forces by removing regional barriers, weakening national connections, and increasing the interdependency among people and between nations” (Lambin et al., 2003: 221).

The impact of globalization trends for land-use change on local communities can be seen in different examples in the here presented study. One example is the globalization of the food system that is highly dependent on the import of cheap Indian food commodities, which in return puts a pressure on the production of local low-value cereal crops such as paddy and maize that are increasingly replaced with high-value cash-crops. Another example is seen in sales of black cardamom and mandarin to international markets such as India or Bangladesh. In that way, the income for farmers who focus mainly on this crop is increasingly dependent on international markets. The venture ‘mountain hazelnut’ is the first 100 % FDI driven project in Bhutan and is a recent phenomenon that has reached Tashithang village in 2015 (see 5.2.4), illustrating the scope and far-reaching influence of current globalization trends in the village. The venture builds on a contract-farming model and has control over large parts of the resource and value chain, providing plant material from China and the US and supplying international target markets. Technical assistance, calculable prices and secure international markets are strong incentives that put additional pressure on local staple crops and might boost the transition from subsistence-oriented agriculture towards commodification and (global) market integration, raising questions of agro-biodiversity and national food self-sufficiency.

Another example that reflects impacts of globalization on a local scale is the intervention by the World Bank in the village, which supported farmers together with the RGoB, to afford more robust cardamom seedlings to reanimate orchards after the outbreak of a cross-national disease (see 5.2.3.1).
6.2 Socio-metabolic transition

"It makes a fundamental difference if societies base practically all of their processes on solar energy, its conversion into plant biomass and, consequently, agriculture as the key energy supply sector, or if they base their processes on fossil fuel energy sources. In the first case, societies as a whole absolutely depend on a positive high EROI (energy return on investment) from agriculture, and if it is low, such societies are constrained in their complexity. In the second case, they can afford to subsidise agriculture energetically" (Marina Fischer-Kowalski et al., 2014b: 28).

From a socio-metabolic perspective, I argue that the study site in Tashithang, located in the critical Buedulum Chhu watershed in Southern Bhutan, is in a transition phase from an agrarian to an industrial socio-metabolic regime as theoretically outlined in chapter 2.1. Even though this case study is specific in time and space, it might indicate certain aspects that are even relevant on a broader level in Bhutan and beyond.

The country of Bhutan was under an agrarian regime, totally dependent on biomass as main energy carrier until the advent of modernization in the 1960s whereas the role and importance of agricultural land-use to provide livelihoods for a majority of Bhutanese people has changed again strongly since the 1980s. Its economy is developing in rapid pace nowadays and the total energy consumption is estimated to increase, mainly based on fossil fuels and provision of electricity on a national level. Biomass still dominates total energy consumption but is increasingly losing its importance. In only 9 years (2005-2014) the share of biomass has decreased from 60% to 36 % and is estimated to decrease further. This shift towards abundant energy sources to boost economic growth is probable to boost material and energy use in the coming years and decades alike with far-reaching impacts for future pathways in the agricultural sector and the society as a whole.

To avoid negative impacts of rapid fossil fuel-driven development on the natural environment, the government of Bhutan follows ambitious attempts in terms of sustainability goals. Current policy strategies, including the middle-path strategy, a vision for 100 % organic agriculture by 2020 (see 4.3.) and a strong commitment towards a future energy scenario majorly based on renewable energy from hydropower generation (see 4.3.2) are examples for an alternative paradigm that aims to find a viable path for sustainable development. However, the case of Tashithang indicates that there are challenges and even contradictions that hamper a development that is meant to enhance material affluence of people and avoid negative consequences of a growth-based, fossil-driven development approach at the same time. From a socio-metabolic perspective, I argue that Bhutan stands at the beginning of a socio-metabolic transition with elements typical for an agrarian regime (see 2.1.3). At the same time the example demonstrates the rise of interferences from underlying causes based on the fossil fuel-driven industrial regime (see 2.1.4). Examples for this development can be found in this local case-study where traditional patterns of an agrarian regime, regarding demographical, economical, institutional and technological aspects have changed and influence individual decision-making in relation to land-use practices.

Transport infrastructure

A road network including different types of roads and highways for (fossil-driven) transportation was built in the region from 1983/1984 onwards and will be extended by an additional highway that shortens the distance to the Indian border (see 5.1.2). This transport infrastructure allows for drastically reduced transportation costs with the help of fossil fuel-driven vehicles and changes economic opportunities fundamentally. In that way, (Fischer-Kowalski et al., 2010) argue that this type of infrastructure creates a long-term impact on the use of energy by a large increase of exchanges between local communities and the outside world (see 2.2.2.1). Availability of cheap imported food commodities from India, dominance of cash-crop oriented agriculture and contract farming models that target international markets represent examples for this development only feasible through institutionally subsidized (transport) infrastructure.
Energy and communication infrastructure
Households in Tashithang were connected to the national electric energy network in 2012 with a monthly number of free energy units provided by RGoB (see 5.1.2.). Together with new compatible technological devices, such as radios, television sets and mobile phones, the availability of affordable energy already altered cultural habits, such as for cooking or communication. The increasing market integration for purchasing such devices is furthermore related to the need for farm households to generate cash income, which subsequently influences cultivation patterns from low-value crops meant for household consumption and local markets to high-value cash-crops. (Fischer-Kowalski et al., 2010) claim that the rise of these communication technologies, linked to electric energy, changes cultural conditions in agrarian subsistence communities.

Fossil fuel based technologies for agricultural production
Different types of fossil fuel based technologies for agricultural production are currently available in Tashithang and are mainly distributed by governmental institutions (see 5.3.2). Mineral fertilizers are widely refused by farmers, whereas pesticides are used on a regular basis (e.g. herbicide in paddy cultivation). Power tillers and grass cutters are currently tested by farmers and might change labour productivity, even though the feasibility of power tiller in Tashithang was said to be limited due to steep terrain. All together these fossil fuel-based technologies might create a "hybrid" situation (Fischer-Kowalski et al., 2010) in agricultural production between elements of the agrarian regime that is based on human and animal labour, and new, fossil fuel-based technologies such as improved seeds, pesticides and machinery.

The case study of Tashithang shows that agricultural land-use change cannot be seen in isolation, but that different causes are strongly interrelated with often-unintended consequences. In that way, the educational sector is linked to the agricultural sector as much as the medical sector etc. A thorough understanding of implications from macro-policies upon local land-use decisions is thereby seen as critical to avoid negative impacts on local adaptation strategies.

Finally, I argue that everything has its cost and that a modernization pathway based on large stocks of non-renewable energy carriers might boost metabolic rates uncontrollably and raise similar sustainability challenges (rural-urban migration, farm inputs and mechanization to raise production, family planning to reduce population growth) as in other regions of the world that are increasingly influenced by an industrial regime, regardless of political attempts to follow a sustainable growth model to avoid these impacts.
7 Summary

A variety of qualitative place-based research methods, such as semi-structured and ethnographic interviews, with participant observation at the core of the approach, were taken in the here presented study to raise perspectives on land-use change in Tashithang village in Southern Bhutan. The study builds on decisions taken by farmers as well as on external driving forces that might play a role for local land-use change. I argue that local transition processes, can be only understood by looking at local variables of land-use change, but reflect more general patterns of broader socio-ecological transitions.

Tashithang village is currently in a transition from an agrarian to an industrial socio-metabolic regime and local conditions are changing in rapid pace. An increasing focus on cash-crops, foremost cardamom and citrus fruits, and more recently hazelnut, kiwi and apples, demonstrate a shift from a subsistence-oriented economy towards an accelerated integration into a (global) market economy that is facilitated by transport and energy infrastructure provided by the government. Economic opportunities are a major incentive for farmers to change cultivation patterns and market their produce (e.g. cardamom, hazelnut). An increasing access to (global) markets goes along with the availability of cheap imported food commodities, which puts additional pressure on locally produced low-value staple crops. The role of money in the village has changed as such during this process and farmers need to earn income to afford basic commodities (e.g. rice), school education for children (mostly in case of private schools), modern consumer goods (mobile phones...) and equipment for agricultural technologies.

Different forms of historical and actual in- and out-migration movements and the breakdown of extended families have strong effects on demographical patterns and concurrent labour availability in the village. Rural-out migration linked to education and training was seen as major contributor that reduces workforce in the village. Labour shortage is an important issue in Tashithang and Bhutan as such and demands for adaptation strategies on household level. On an organizational level, farm households follow a strategy to combine household labour, service exchange and hired labour as to their resources and need. On a technological level, farmers use pesticides on a regular basis either for the protection of crops (e.g. citrus greening) or to reduce the labour demand by using herbicides (Paddy and cardamom cultivation). High-yielding cereal seeds (e.g. maize, wheat, etc.) are subsidized at 50 % from the government and can be ordered at the regional RNR office. The use of machinery in agriculture is little developed in the village until now. However, farmers and village representatives repeatedly mentioned mechanization as viable solution to tackle labour shortage. Two small machines are aspirants to increase labour productivity and are currently tested by farmers. These are namely power tillers and grass cutter that are increasingly used to reduce labour demand in cardamom weeding. The country of Bhutan is developing in rapid pace and this case-study on land-use change, that is inherently interrelated with other societal sectors, shows a trend of modernization and industrialization that was also noticed in other countries and can be termed as socio-metabolic transition from an agrarian towards an industrial socio-metabolic regime that goes along with specific and far-reaching implications for sustainability.
8 References


WMD, not publ. Watershed Management Plan - Watershed 144a, Dagachu Sub-basin, Punatsangchhu basin. Watershed Management Division, Thimphu, Bhutan.
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## 11 Annex

### 11.1 Coding of Interview partners (Farmers and Experts)

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<tr>
<th>Interview partner</th>
<th>Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer 1</td>
<td>F1</td>
<td>Cash-crop focus; Elderly couple permanent on the farm</td>
</tr>
<tr>
<td>Farmer 2</td>
<td>F2</td>
<td>Shift to cash-crop (cardamom and hazelnut); Farmer worked as staff in hydropower project; returned to his land</td>
</tr>
<tr>
<td>Farmer 3</td>
<td>F3</td>
<td>Young woman, back to village; rural out-migration; Generation gap.</td>
</tr>
<tr>
<td>Farmer 4</td>
<td>F4</td>
<td>Old farmer, Cowboy, historical livelihoods</td>
</tr>
<tr>
<td>Farmer 5</td>
<td>F5</td>
<td>Educated, retired farmer; Focus on cash-crops (esp. hazelnut)</td>
</tr>
<tr>
<td>Farmer 6</td>
<td>F6</td>
<td>Son and father; Resettler, focus on cardamom, generation gap;</td>
</tr>
<tr>
<td>Farmer 7</td>
<td>F7</td>
<td>Elderly couple, only cardamom, human-wildlife conflict prevalent;</td>
</tr>
<tr>
<td>Farmer 8</td>
<td>F8</td>
<td>Middleman; one of the richest people in village; well informed</td>
</tr>
<tr>
<td>Farmer 9</td>
<td>F9</td>
<td>Resettler; land tenure conflict (Drukpa/Lhotsampa); focus on contract work and cash-crops</td>
</tr>
<tr>
<td>Farmer 10</td>
<td>F10</td>
<td>Tsogha of Tashithang; Traditional cattle rearing; Focus on cardamom; well informed</td>
</tr>
<tr>
<td>Expert 1</td>
<td>E1</td>
<td>Program director of National Organic Program (NOP);</td>
</tr>
<tr>
<td>Expert 2</td>
<td>E2</td>
<td>RNR extension officer Gesarling Geog</td>
</tr>
<tr>
<td>Expert 3</td>
<td>E3</td>
<td>RNR extension officer Gesarling Geog</td>
</tr>
<tr>
<td>Expert 4</td>
<td>E4</td>
<td>RNR extension officer Gesarling Geog</td>
</tr>
<tr>
<td>Expert 5</td>
<td>E5</td>
<td>FDF company staff; Cash-crop hazelnut in Gesarling Geog</td>
</tr>
<tr>
<td>Expert 6</td>
<td>E6</td>
<td>Agricultural expert, RNR-RDC Yusipang</td>
</tr>
</tbody>
</table>
11.2 Guiding questions for Interviews with farmers

(1) What are your sources of cash-income in these days?

(2) What are your crops that you grow for your self-consumption here on the farm?

(3) Do you remember in what moment you decided to focus on this and what were the reasons for that?

(4) Which advantages / benefits do you expect from your strategy for you and your family?

(5) How far have your expectations come to happen?

(6) Can you tell me something about the life on the farm in the past (before your focus on ... ?) How did you manage the life in these days?

(7) What have been important things for you that have changed in the last years on the farm?

(8) What have been important changes in the village as a whole?

(9) When you consider the situation on this farm, what are the challenges at the moment concerning livelihoods but also the life of family members in general?

(10) What might be risks for you and your family in following this current way of practicing agriculture?

(11) What are your children doing at the moment? What are their plans for the future?

(12) Can you tell me something about your future prospects? How will the future look like on your farm?
11.3 Guiding questions for Extension officers and village representatives

1) When did the people in the geog start with permanent agricultural activities?

2) How does the land-tenure system in this region work?

3) How much free AC-land is available in the geog?

4) What is the average size of farm land that people own on average?

5) What are the different types of land-use found in the geog?

6) Which role do agricultural activities play today for sustaining the lives of the farmers in this geog?

7) What food and cash-crops have been grown in the geog in the past and today?

8) Which role has the forest for the farming system?

9) What is the role of the livestock for the local agriculture?

10) How is the availability of water in the geog?

11) Are there any cases of crop-depredation through wild animals in the geog?

12) What are marketing opportunities for farmers to sell their products?

13) How is the workload for farmers distributed over the year?

14) Which role plays mechanization in the geog?

15) Which agricultural activities have been conducted by the government so far in the geog?

16) What main interventions are planned for the geog in the future?

17) What is the current aim of the government for the agricultural sector (in this geog)

18) How will this geog look like in the future according to agricultural land-use?
11.4 Cut & Carry System - Feeding the cow

Dali is a woman of around 40 years with a charming and open smile and character. She came to live in the village of Tashithang only 10 years back. The family bought a land of three acres in the village on which they constructed a small house. The woman is part of the ethnos Sherpa, which is one of several different ethnics that live in Bhutan, having a particular language and culture. Her mother tongue is Sharchopa, a language from eastern Bhutan. Besides that she is fluent in Dzongkha and Nepali and is just on the way to learn English in a program of NFE (Non Formal Education) that takes place once a week at her farmstead. Most of the time, the woman stays alone at the farm, as her husband works and lives in a neighbouring village. The younger children live in the house of their grandmother in again another village from where they visit their school, while the eldest daughter has left the village to study in a government college in another part of the country.

On her land, she has planted 2 acre of cardamom and one acre of maize on dry land. Three cattle, one cow, a young calf and a young bull are tethered in a fixed stable right next to the house. These animals provide a continuous income for the woman as long as the cow gives milk. It is the improved 'Jersey' breed, which can be found increasingly in the region. This breed gives a larger amount of milk in relation to the local cattle. In return, the animals also need more fodder that needs to be rich in content. The following case shall reveal aspects of farming practices, realized on a daily routine with a focus on a stable-feeding livestock system:

A huge pot for the preparation of fodder is already cooking over open fire when I arrive at her farm at 06:30 this day. Different ingredients such as leaves and stems of a cassava species (phul tarul [Nep.]) are put inside the pot. This mixture serves as evening fodder for the animals. A huge bunch of grasses and twigs with leaves from a fodder tree lie in front of the stable. The big cow already got the morning meal and is just finishing the rest of it. After completing some small duties around the house, the time has come to milk the cow. First she unfastens the young calf that immediately heads directly towards the cow and starts drinking from the teats. After 20 seconds, the calf is brought back and is tethered again next to the cow. Now TS takes a rope of one centimetre in diameter and uses it to fasten the hind legs of the cow. From the kitchen she brought a metal bucket with 5L capacity. With a small footstool she sits beside the cow and starts milking. Continuously she keeps on milking until the cow starts to get agitated and tries to get free from the rope. The woman stops the process and fastens the rope tighter. After around 15 minutes the procedure is done and the calf finishes the rest of the milk. The cow seems to be very unimpressed of her young calf but in contrast seems to be very impressed of the Napier-grass that grows on the farm and was given now in her feeding pot. Also the bull and the calf get a big, yet smaller portion of the grasses.
Back in the kitchen, the milk from the bucket is now poured through a sieve in another pot. Subsequently the content is divided in different container for the preparation of cheese and butter. A part of the milk is kept for self-consumption, so is the buttermilk as a side product from the butter preparation. A big container is used for the preparation of cheese. She takes it out to the open fireplace. The pot with fodder is put aside, whereas instead the pot with fresh milk is put over the fire. She asks me to stay there and to stir the content slowly but constantly. Meanwhile she starts to prepare the breakfast. After a while, the milk starts to coagulate and the water gets separated from the milk protein. This process is finished and she brings the pot back in the kitchen. The pot with fodder again gets its former place and continues to simmer gently. The woman tells that she produces 2.5 kg of butter each week. For that she can get between Nu. 300–350 (4–5 €) / kg. Furthermore she makes 8 small pieces of cheese per day and 40 per week, which she can sell for Nu.25 (0.40 €) each. As she finds no time to sell the products on the weekly market, she always asks the mother of the village head to sell them for her.

Now we finish the preparation of the breakfast together. Chapati – an indian type of flatbread together with a potato-chilli curry. After breakfast she is doing the dishwashing in front of the house next to the open fire. In the next step, the woman takes her sickle and puts on her blue gumboots that seem far too big for her. It is time to get the fodder for the greedy cow. We both take a sickle. First, the tools are sharpened at a big grindstone in front of the house. From the stable she takes a big bamboo basket and starts walking down the slope. It looks like this part of the farm has been a vegetable garden in former times. In this summer season now the plants are growing in abundance and wild grasses are already overgrowing the field. We cut down a small part of this field and pile the grasses up to make big bunches. The bamboo basket is now filled up with grasses. A carrying strap on the traditional basket serves to facilitate the carrying of goods. In a crouching position TS puts the strap on her forehead before she stands up again, carrying the basket on her back. Packed with 25–30 kg she tramps up the slope, slowly and steadily to empty out the basket in front of the stable. When she comes back we repeat this task two more times in order to collect the amount needed for this day. When we finished the work, the woman leaves to prepare lunch for us, which is a potato-pumpkin curry with a mixture of maize and rice. Only the leaves and shoots of the pumpkin are used for the dish. Fresh buttermilk is served to the food. After lunch we continue to peel garlic that she is also going to sell for Nu. 100 (≈ 1.39 €) / kg on the weekly Sunday market.

Figure 34: Feeding the cow. Cut & Carry system (own picture: 05.08.2015)
11.5 The farm in Tashithang – A small case-study on land-use change

During the research process in the village of Tashithang I was invited to stay as a guest at the farm of the local village head. At this farm I spent most of my time during the research, taking the farm-household as primary and focal learn and study field. Here it was possible to observe daily routines of people, to participate in farming activities and to get involved in community activities. Apart from the on-farm research, the farm was always starting and end point of research activities in the village. This permanent contact gives me the opportunity to present the farm as small case study on which I will exemplify details of land use change. Here I want to describe the farm, certain elements of the role of its household members and give a general impression of the farm household as unit of analysis about land use change.

The farm
The built-up structures of the farm consist of two main buildings, furthermore a toilet/bath cabin, two old fixed stables and a changing number of semi-permanent cowsheds. The two main buildings are used for different purposes. The smaller building is foremostly used as kitchen and storage room whereas the larger main building is used mainly for sleeping and storage purposes.

The main house was built in 1989 after the kitchen building that was already constructed in the 1960s. It’s foundation is made of concrete while the walls are built in a traditional way, using mud, cow dung and wood for its structure. Furthermore, stones as well as bamboo are used and the roof is thatched with a metal sheet. The front side of the house appears white, with green painted pillars. The lowest 50 cm of the building are painted with an ochre-coloured mud-water mixture.

Figure 35: Farm of the village head - main house with courtyard (own picture: 11.09.2015)

The ground floor is heightened in contrast to the courtyard - which might be to prevent the entering of water during the season of heavy rainfall. A terrace, like a small forecourt appears right before the main entrance comprising a wooden bench that is used by people and animals alike. Here on the terrace all shoes of the family like slippers, sneakers or gumboots, are stored right next to the entrance. A wooden, green coloured eye-catching balcony appears on the second floor. Especially during the rainy season, wet clothes are usually hanging under the roof for drying. There are two doors, the main entrance on the east side, and one entrance on the north side. The door is entirely made of wood, painted in dark green, with the ochre colour at the bottom of the door. The doorframe is painted in sky-blue and is extensively decorated. Inside the house there is only one extended single room. This room is quite dark due to the absence of windows.

The ceiling of the room is low with less than 1.90m of height and serves at the same time as the base of the second floor. One central wooden pile, painted in blue, stands in its middle. Right before that a wooden bench is standing near to the entrance, topped with a grey-coloured plastic mat. At the time this bench is mostly used for watching TV, which was bought only 4 months ago and has become an important meeting point in the household. With the possibility of cable tv the family can receive many - also international - TV channels. Next to
the television set is the refrigerator that is the only source of noise during the night. It is red coloured and great parts stay empty most of the time. Beds take the biggest share in the room. Three of them are standing next to the outer walls. Two normal single beds and one double bed for wife and husband. This double bed has a mosquito net fixed on the ceiling and 4 well prepared blankets on it. The other two beds supposedly serve for the accommodation of guests. The walls, which are of ochre-colour, are decorated variegated. Wallpapers of the second and the fourth Bhutanese king are hanging there as well as a wallpaper of an important Kirat guru and a manifestation of Buddha. The second floor is the reign of the grandmother. One big bed stands in the middle of the room, which is subdivided with a smaller room, which is filled inside with holy symbols and merely used for religious rites.

The kitchen

Entering the farm from the front side, the first building, a small house serves foremost as a kitchen and is separated from the main house through a yard. Eating on the farm follows certain rhythms but is adapted to the necessities of the people’s tasks during the day. This building, where the eating takes place, is not only a kitchen. It is also the most important place to socialize within the family, with neighbours and friends. Nonetheless, the kitchen is also a place to work. Cooking of meals or fodder for the animals, preparation of cheese and butter, or sale of seeds are some of the tasks fulfilled foremost in the ground floor of the building. This ground floor was perceived merely as a semi-public space that is not reserved for a closed, private circle of people but for each and everybody to enter the sphere of the household. The kitchen building is older than the living house, having now 55 years, and is mainly built out of stones, an adobe-cowdung mixture and wood. The base is done by stones, which are covered by clay.

Figure 36: Kitchen building made of clay, thatched with metal sheets (own picture: 26.07.2015)

The building is thatched by metal-sheets that have already become partly rusted due to chemical oxidation processes. Observing the building from its front-side, it seems to be totally dark inside. The entrance is always held open during daytime, while it gets closed when all the people leave the place for working and also during the night time with a simple metal fixation. The major part of the outer walls is painted in white (lime), while the lowest 50cm appear ochre-coloured. This colour is naturally produced through a mixture of mud and water and is painted around the whole building. Just recently this part of the building was painted again, which makes the colour at the moment to appear more intense with a strong red tone. A small terrace that is already under the roof serves for several purposes. The people use it to sit outside or do different works when they need protection from rainfall or strong sun. The small space is filled with different tools such as knifes, sickles, buckets for milking and a scale that is needed by the grandmother for the local market on Sundays. Shoes are pulled out before entering the kitchen and are put next to the entrance.
The kitchen building has two floors. The ground floor consists of one big room with a base of clay. Natural light can enter from the main-door and from a smaller door on the side of the building without any windows. The ceiling is totally black due to the smoke of the fire that penetrated the wooden piles over decades. Therefore, the room appears quite dark in general, whereas the walls inside the room are all built of clay and appear in an ochre-coloured tone. In the right corner, in the hindmost part of the kitchen stands a small traditional clay-stove. This stove is very low, about 50 cm of height, 1.20m in length and 80cm in width. It is fuelled with firewood and some clay bumps on top of the stove serve for placing pots and pans over the fire. A metal tube with a diameter of about 1–2 cm is used to strengthen the fire through air influx. To enlighten the fire with this method it is needed to nearly crouch down on the ground.

When the electricity is cut off and the traditional stove is demanded for cooking purposes, a small cup of kerosene is often used to fasten the process of enlightening the fire. Before the introduction of electricity in the region in 2012, this stove was the only cooking facility in the kitchen while nowadays two electric rice-cookers, an electric pan, as well as a device for boiling water are used frequently for cooking purposes. The family would have had the possibility to construct a new stove, which was promoted from the government. This 'improved' stove works with a chimney in comparison to the traditional stove and should have had two main advantages according to the institution that is promoting this kind of facility. First, it should help to reduce the smoke produced inside the room through the chimney for health and also for aesthetical reasons. Besides that, it should decrease the amount of firewood needed for cooking, which would mean a more efficient use of energy. The family has so far decided against this new stove, as from their perspective it would need a greater amount of firewood than the traditional one. This perspective is shared by different other households who just keep on using their small traditional stove for efficiency reasons and refuse the argument of health risks. The new electrical devices are standing on a shelf right next to the stove, also in the back half of the kitchen.

Furthermore, the cooking tools, such as teapots are stored just below them. Another shelf next to that is used for the storage of pans, pots, glasses, plates and everything else that is needed for cooking and serving the food. Together with the electric cooking facilities, electric light has been installed in the kitchen. One bulb enlightens the dark room during late hours while an electric plug socket was installed next to the devices. Another point about electricity is, that its availability of is not constant and reliable, especially during the monsoon season from June to September. Hardly every day, the light will be cut off for hours without warning, which demands for constant use of traditional facilities.

In the front part of the kitchen - in one of the corners - rice, grinded maize and flour are stored. Rice is omnipresent in the household and is mostly served 3 times a day. Just next to it, a manually driven mill, called zaato, is installed. This mill is a quite simple but useful construction, consisting of a base of clay of about 25cm in height. A stone with a diameter of around 40cm was put on that base. The millstone is of round and flat shape and has a hole in its centre. A wooden stick, fixed in the clay base, goes through the hole of the stone, keeping it on its place. A grip is fixed on this stone that is used for the rotary motion. Although there is an electric mill for maize and paddy grinding available in the village, this hand mill is still used in the household. Maize, that is usually grinded with it, is put into the hole in the middle. When the mill is "started" it makes a very particular
and loud sound that one can recognize easily. The stone is moved in one direction until the grinded maize is transported from the centre to the borders until it falls down next to the mill. Different sizes of grinded maize are differentiated that serve for different purposes and so the process can be repeated until the requested size is reached.

One massive wooden pile in the middle of the kitchen connects the wooden structure with the ground. Around this wooden pile, near to the traditional stove, the people tend to sit on round-shaped seat carpets that are hand-woven from rice straw. People mostly sit on these carpets with crossed-legs. Sitting in this position they can sustain over a long period of time.

The upper part of the building, which can be reached through a steep hybrid between stairs and ladder, serves as a storage room. At the moment the main part of maize harvest is kept up where one part was hanged over a bamboo stick while the bigger part was just laid on the ground. A separate wooden box is used as a storage container for the paddy after harvesting in wintertime. While this wooden box is now full of other things, it will be cleaned properly before the fresh rice is put inside.

Figure 38: Maize stored in the upper part of the kitchen (own picture: 18.09.2015)

Also a plastic sheet will be put against any contamination of dirt and dust. This second floor is a potpourri of many different things. Baskets and pots, sieves and ropes can be found in this second floor. Useful and broken farming tools lay side on side. The rice, bought from the market and currently used as daily food is stored here in common plastic bags. There are also a few plastic utilities such as bottles and old bags of rice while the majority of the things seems to be made in 'older times' and are mainly made from natural resources such as bamboo, wood, rice straw or metal in the case of pots and pans.

From the three household members that live permanently in the house, the wife of the Tsogha is in charge for cooking in most cases. Only in special occasions her husband or her mother-in-law are overtaking this duty. In major parts the food served on the farm is vegetarian containing a big share of dairy products, which they take from their own cows. As followers of the Kirat-religion the family members should not eat pig, chicken, beef or eggs. However, it seems like a beloved habit from the past of the host to eat meat and fish. Therefore, fish, buffalo meat or mutton are served from time to time after a shopping tour in the nearby town.

During this summer season most of the vegetables that are used in the kitchen were grown on the farm itself, thereby having a high self-sufficiency in vegetables. Fresh as well as stored vegetables are combined to prepare a variety of different currys. Vegetables that are suitable for storing over a longer period are kept in the second floor of the main building, which are mainly potatoes, garlic and onions. Before preparing the food in the kitchen, the wife is collecting vegetables and spices around the farming house or from the stored vegetables in the upper part of the main house. The vegetables get washed before cooking at the standpipe next to the kitchen. When there is light, the rice-cooker is used to prepare this most important part of the meal. The vegetables are usually cut in a cowered position without using any cutting board. The rice-cooker and the electric pan are the tools most often used for preparing the rice and the curry, the two main "ingredients" of
most of the plates. Spices play a central role in the local cuisine. Apart from chilli there are several spices used such as: black sesame, nepalese pepper (timbur), ginger (aduwa), pepper, clover, curcuma (haldi) apart from others. Two tools are used for the grinding of spices. There is first a big wooden mortar where also Pickle (acchaa) is prepared in which is used more for softer spices. Furthermore, a simple tool, consisting of a flat and a round stone, is used for crushing hard spices such as masala. Using this tool, the woman sits in a crouched position and rolls the round stone back and forth. This activity needs a good technique and some strength to be fulfilled. Several different drinks are offered with the dishes. White tea, meaning black tea with milk with or without sugar is given very often, also apart from the meals. Furthermore, hot water is served very frequently. Finally, dairy products - such as buttermilk or hot milk complete the variety.

A big bunch of rice is served on a main plate for each person. Besides that, depending how elaborate the dish is, one, two or even three small bowls filled for with curry, lentil soup (dhaal), or pickle are served. The pots with food are standing between the eating people. After a short time, the wife asks for a second share "extra rice" and or side dishes. If this is not wanted it is necessary to make a clear statement. That means to put the hand over your cup or plate or simply to take the plate away and "protect" it from refilling. Just to say "no" does not work and again a big bunch of rice needs to be eaten up.

Normally three dishes are taken per day. But it is also possible to have an "in-between dish" during the day. The dishes are mostly salty. The most common sweet "dish" is to take biscuits in the early morning or when there is not enough time to take a whole meal. Depending on the activities of the day, the breakfast is usually taken quite late at around 10:00 after some work has already been done. But during my stay it was also common to take breakfast in the morning at around 07:00 - 07:30. Lunchtime will be usually taken between 12:00 and 14:00. The dinner is served between 18:00-19:00. The eating hours can change pragmatically due to the necessities of the people. This depends strongly on the duties of F10 who cannot always manage to reach the house in time. In these cases, it might happen that the food is taken earlier or later as usual.

During the evening hours, starting with the dinner, the kitchen is becoming a communicative space. The work for the day has been done and the family sits together, eats, drinks and talks. Also when guests arrive they are usually invited to enter the kitchen where they get food and or drinks. In these days the household members also tend to substitute this time of sitting and talking with television shows on their brand new TV-set.

Inhabitants

Three people, a couple and the old mother of the spouse live and work permanently on the farm in Tashithang. The couple has 4 children together from which 3 are staying in Gesarling central school 17 km away from the village, whereas the eldest son is a student in a private college in Gelephu, one of the larger cities on the border to India. Generally, the children come home only during their vacation time in summer (2 weeks) and winter (2–3 months).

Figure 39: Permanent household members in farm of F10 (own picture: 07.10.2015)
The grandmother
In the morning, between 05:00 and 05:30 she is usually the first person awake who comes down the stairs, starting with the daily routines on the farm. GM is the mother of the village head, and yet having 73 years, she is still impressively fit and active. Together with her husband, who has died 5 years back, she has started to reclaim the present farmland 53 years back. The two of them have created the rice terraces and gained everything from the soil for sustaining their lives. It seems that she is used to hard work and in a slow but continues manner she used to work from morning 05:00 till in the evening after dinner. As a proof of esteem that she enjoys in the household, she is always the first person, who is getting the food that is served, only in her case, on a heavy bronze plate. The old lady is part of the Subba caste and follows the kirat religion, like the whole family does. This religion was said to be indigenous in Nepal and has recently been revitalized in the region among certain castes of Rai, Subba and Limbu. On the farm her tasks could be summarized as subsistence activities in the sense that she is taking care for the vegetable garden as well as for feeding the smaller animals on the farm. Furthermore, she is giving a special focus on the recollection of local seeds. Apart from these home activities, the grandmother used to sell different products on the weekly market in Dagapela town, where she earns additional money that is, according to her son, her own money that is not part of the household account.

The village head
Some people say that he is like the backbone of the Tashithang community. He knows very well how to motivate his people and when he arrives at any work or task that has to be done, such as the work in the community forest, the people follow his example and work together. In other cases, when he is not present, it is said that the work is not well one. He seems to know each and everybody and all the stories behind the people. Due to his duty as local village head there are many different tasks to fulfil that also distract him from his duties as a farmer. One big and important task is the representation of the Tashithang community on the administrative level. Every Monday he needs to go to the block office to Gesarling to hand in documents or reports from his community. In meetings on development activities and budgets he has to be present to bring in the wishes and demands of his community and he is said to be always one of the most active voices during meetings.

Apart from that, he seems to be in charge for all the small and big problems in the community. When there are important discussions in family cases, people who are sick and need a "taxi" to go to the hospital to Dagapela, in all these cases the village head will go and help.

The housewife
Traditionally, in the culture of the Lhotsampas (southern Bhutanese people of Nepali origin) women have left her original household to join a husband at his place. So in the here presented case. The wife, and mother of four children, had come to this farm after her marriage and plays undoubtedly an important and indispensable role. The women foremostly conduct daily routines on the farm so she usually wakes up before her husband to start with the preparation of the breakfast. Her activities can be outlined with a range of household activities such as preparation of meals, as well as washing of clothes on the one hand. Cooking is usually done three times a day and takes a lot of time, including dishwashing. On the other hand, due to the responsibilities of her husband, the woman is in charge of many duties on the farm and together with her mother-in-law spends most of her time on the farm. She is predominantly in charge for the handling of the cattle and is usually also doing the milking and the preparation of cheese and butter.
Farming practices

The total land on the farm is ≈3.8 hectare (9.5 acre), which is divided in the following land categories:

- **Dry land**: 1.2 ha (3 acres)
- **Wet land**: 0.5 ha (1.35 acre)
- **Orchard**: 2.1 ha (5.15 acre)

![Diagram of Farm of F10 with respective land-use types (own illustration)]
Main crops presently cultivated are: Maize, paddy, potato, cardamom and vegetables. Maize, paddy and potato are grown for self-consumption, whereas a part of the maize and potatoes is additionally sold locally. Cardamom is the main cash crop on the farm and is increasingly cultivated on the farm on 2–2.4 ha (5–6 acres) in total. Vegetables are grown both for self-consumption as well as for marketing purposes on the local market in Dagapela and for the Gesarling central school.

Figure 41: Maize harvest (own picture: 16.09.2015)

<table>
<thead>
<tr>
<th>Crop</th>
<th>area</th>
<th>harvest</th>
<th>income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardamom</td>
<td>5,15 acre</td>
<td>90 kg</td>
<td>Nu. 100.000</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0,40 acre</td>
<td>?</td>
<td>Nu. 30.000</td>
</tr>
<tr>
<td>Maize</td>
<td>1,5 acre</td>
<td>1200 kg</td>
<td>Nu. 3000</td>
</tr>
<tr>
<td>Potato</td>
<td>0,25 acre</td>
<td>200</td>
<td>Self-consumption</td>
</tr>
<tr>
<td>Paddy</td>
<td>1,35 acre</td>
<td>500-600 kg</td>
<td>Self-consumption</td>
</tr>
</tbody>
</table>

Table 16: Area and production of main crops (estimated by F10)

A range of different fruits and vegetables are found on the farm additionally to the main crops that are either consumed at place or sold by the grandmother on the local market in Dagapela every Sunday depending on seasonal availabilities. Among these plants are:

Cucumber (kaakraa), chayote squash (Iskush), pumpkin (pharsri), banana (kera), tomatillo (bi), radish (moola), eggplant (baygun), coriander (dhaniya), beans (puri), spinach (sag), pear (naspati), tree tomato (golbera) and round chili (doel khursani).

Mono cropping pattern is done for the cultivation of cardamom and paddy. In the case of cardamom, Tite Pati (Artemisia sp.) a local wild plant is kept between the cardamom plants to protect the plant from direct sunlight and frost and is also used to protect soil from erosion and serves as green manure. Maize is partly cultivated applying double cropping with beans and or with pumpkin. In case of the maize/bean double cropping system, the stems are kept in the field after harvesting to serve as climbing aids for the upcoming young bean plants.

Livestock
A range of different animals is kept on the farm. The largest animals present are local breeds of cattle. The farm household owns two cows, one heifer, two calves and two bullocks. Apart from the cattle, the family keeps 11 goats from which 2 are very young ones. The goat milk is not used but the animals are kept for meat purposes, both for self-consumption and sales purposes. Chicken run freely on the farm and their eggs are sold on the weekly market. Two watchdogs, and two cats, hunters of rats, are completing the ensemble. The importance in terms of cash income of different animal types is presented below.
According the livestock system and cattle rearing, the village head explained me that they are still using the "old" system, whereas nowadays people shift towards a livestock system that includes high-breed cattle and a stable-feeding system where the animals are tethered permanently.

In their case, the cattle stay at the farm only in case of need or when they are in times of lactation. They are tethered under simple, dismountable cowsheds and can be moved easily from place to place. In that way it is possible to take the animals to the fodder source instead of carrying the fodder to the animals. When the animals are of no use on the farm, they are left in the surrounding forest where they run free to feed themselves. The cows are used for milk and manure purposes. From the milk, the two women produce cheese, butter, and get buttermilk and yogurt as 'side-products'. Cheese and Butter are sold on the local market in Dagapela every Sunday morning. Bullocks are needed for ploughing purposes as the substitution with power tillers for ploughing was claimed by the village head as being only feasible on paddy fields in this village. The rest of the terrain would be too steep for its usage.

![Temporary cow-shed (own picture: 12.09.2015)](image-url)